UNIVERSITY OF ALBERTA

STUDENTS AND TEACHERS LEARNING TOGETHER IN TECHNOLOGY-RELATED PROFESSIONAL DEVELOPMENT ACTIVITIES

BY

LORINE PHYLLIS SWEENEY

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DEDICATION

This thesis is dedicated to students everywhere who contribute so much to the learning of their teachers.

Abstract

This qualitative interpretive study was designed to examine experiences of teachers and students as they worked together in a technology-related professional development activity. Specifically, the study was designed to look at the experiences of both teachers and students as students assume the role of instructor to their teachers. The study adds to the research about effective professional development regarding technology implementation in schools and the role that students might have in that process.

The ten participants were purposively selected from among the thirteen students and thirteen teachers who participated in the professional development activities. The teachers and grade nine students selected for the study were both articulate and reflective and were likely to be able to provide insights needed for the study.

Interview data were collected through audiotaped semi-structured interviews, and follow-up interviews occurred with selected participants. Using NVivo software, interview data were organized into categories and then into themes. Trustworthiness was enhanced throughout the research process through external auditing and member checking by study participants.

Findings of the study were presented from both student and teacher perspectives. Students found that they were rewarded through interaction, involvement, mentoring, and positive feedback. Teacher understandings focused on

beneficial student-teacher relationships and on effective and meaningful professional development that led to changes in practice.

Implications for policy and procedure drawn from this study include the need for policy makers, researchers, teachers and pre-service institutions to continue to examine how teachers integrate technology into their classes, the role of technology in constructivist classrooms, and the role of students in their teachers' professional development in technology.

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CHAPTER ONE

INTRODUCTION

Teachers across North America are being asked to enhance their practice through the use of technology. In preparing to integrate technology into the curriculum, these educators are faced with new computers, new software, new curriculum and new ways of teaching and learning. Not only are they expected to understand basic computer programs, they also are asked to integrate technology into their teaching and to use it in conjunction with greater emphasis on learner-centred pedagogical strategies. Effective integration of technology, however, does not come without professional development that supports and guides teachers as they change their practice (Ringstaff & Yocam, 1995).

Recent research in the United States has shown that those in leadership positions struggle with finding staff development that will effectively support teachers. Although there is much time and money spent on technology, there is little satisfaction with the current methods of preparing teachers to use the technology available to them (Siegel, 1995).

In the United States, the Office of Technology Assessment (OTA) was established in 1972. OTA's mandate was to provide the Congress with an objective, thorough analysis of many of the critical technical issues of the day. The agency offered sound principles for coping with technological change in industry, in the Federal Government, in the work place, and in schools. Although there was no similar agency in Canada, the agency's findings continue to be valued by researchers who are

studying technology within school settings both in Canada and in the United States. In 1995 the Office of Technology Assessment in its report *Teachers and Technology: Making the Connection* found that relatively few teachers were using computer-based technology for instructional purposes. In addition, Abdal-Hagg (1998) found that technology was not effectively being incorporated into the existing curriculum and that inservice programs did not necessarily use the most useful and current methods to support technology.

In my work, I often need to consider what are the kinds of professional development activities that might be useful in assisting teachers in our school district to effectively integrate technology into their daily practice. I am part of a team responsible for leading teachers in our school district in the infusion of the Information and Communications Technology (ICT) curriculum into existing curricula and programs from Kindergarten to Grade 12. I often witness the glazed eyes of teachers who are asked to spend an hour or two after school to learn a computer application or an Internet skill. I listen as they worry that, by the time they get around to trying to use the knowledge in a meaningful way in the classroom, they will have forgotten what they have learned or they will possess little confidence in teaching the skill to their students.

What I am beginning to understand about effective professional development has been articulated in part by Showers and Joyce (1996). Showers and Joyce's early 1970s research studies revealed that as few as 10% of participants in staff development programs actually implemented what they had learned. Reflecting on fifteen years of research, primarily involving peer coaching, these researchers again in 1996 confirmed

that teachers who attended fragmented professional development sessions and who worked in isolation consistently demonstrated new skills far less frequently than those who learned collaboratively with a focus on classroom application.

Arriving at the Question

As I struggled with how to increase teachers' enthusiasm during technology-related professional development activities, I recalled instances in my own career when I observed teachers who were engaged and excited while participating in out-of-classroom experiences. I noticed that teachers, including myself, came alive when they were working with and learning with their students.

For me, an example of such teacher-student interaction occurred when technology was new to the schools and I was the teacher-librarian who looked suspiciously at the brand new computer and CD ROM delivered to the library "just for me." I didn't know how to turn the computer on--I didn't even know what a CD looked like. Where could I learn? Who could I turn to for help? I bought some books and enrolled in some short courses; however, I had just begun my Master's program and I felt overloaded. Then my students arrived--eager to learn and eager to share. Suddenly, learning the technology became exciting, practical, collaborative, and fun. As students learned something new, they enthusiastically offered to teach the skill to me. Together we learned how to access the Internet, how to use A*ppleworks*, how to draw a graph, and together we memorized all the keystrokes needed to format WordPerfect documents.

Then HTTP arrived! How excited we were about the World Wide Web. One student, Patrick, came to the library during his free periods and during noon hours to show me what he had learned the night before. Together we created lessons and examples to share with others in the school. As I became excited about my learning, other teachers and students sometimes joined us to see what we had learned and to share some of their own findings. Together we formed an informal technology learning community: we taught, we learned, and we enjoyed each other while pursuing a common goal. One teacher and myself, with Patrick's help, even provided lessons about computer and Internet use to an adult continuing education class. Patrick began spending all his prep periods and many after school hours in the library as we explored and taught each other. I remember the night Patrick came in excitedly announcing that now we could hear *sound* through the World Wide Web. We s-l-o-w-l-y downloaded RealAudio--it had just been released as a program that week. When we got it to work and actually played a sound file, we were so excited! This learning experience was for me far superior to professional learning through courses or books. I felt energized, youthful and enthusiastic.

Reflecting on my own experience, I began to wonder, since effective use of technology is a skill for which many teachers currently lack expertise, what the experience would be like if teachers and students were to learn and teach together. Would this type of learning facilitate teachers' use of technology? Would learning from the students be seen as meaningful to teacher practice? Would students develop a sense of belonging and feel a stronger sense of school community? Would the experience facilitate change and growth? Would the experience affect teaching

practice? Would there be benefits and understandings that I hadn't thought of? Keeping these questions in mind, I planned a study of situations where students and teachers learn and teach together and to explore how the participants experience this activity.

Purpose of the Study

The main purpose of this study was to gain insight into how teachers and students experienced teaching and learning together in a technology-related professional development activity. Being a part of the study provided participants with the opportunity to develop personal understanding and insight through reflection, interviews, and participation in the activity. Van Manen (1997) explained that, by "gaining a deeper understanding of the nature of meaning of our everyday experiences" (p. 9), we can arrive at insights that have not previously been considered.

Research Questions

My research question was: How do students and teachers experience learning and working together in a technology-related professional development activity?

This main thrust of the study led to other emergent sub-questions such as: (a) What was the experience like for the teachers and students? (b) How did the participants feel during the experience? (c) What was meaningful about the experience for the teachers and students? (d) What were the benefits and rewards of the experience to the teachers and students? (e) Did the experience change the

teachers' practice? (f) Did the experience change the relationship between the students and the teachers?

Significance of the Study

This study is of practical and theoretical significance. The results of the study could contribute to our understanding of, and perhaps change, the role of both the student and the teacher as technology is integrated into the classroom curriculum. As educators understand more about professional development and the students' role in the process, they may develop new professional development models with more collaborative starting points. The study has potential to add to educational theory related to the integration of technology into core curriculum, the stages teachers go through on their way to effective integration, and the changes in practice needed for this integration to occur. My study may also affect the way educators conceptualize teacher-student relationships, and it may encourage us to examine whether in a constructivist environment students are not only at the centre of their own learning, but whether they may be part of their teacher's learning as well. The study may also provide insight for school administrators, school boards, teachers and university educators as they address issues related to technology integration.

Chapter Summary

This qualitative interpretive study was designed to examine experiences of teachers and students as they worked together in a technology-related professional development activity. Specifically, the study was designed to look at the experiences

of both teachers and students as students assumed the role of instructor to their teachers. The study adds to the research about effective professional development regarding technology implementation in schools and the role that students might have in that process.

CHAPTER TWO

REVIEW OF THE LITERATURE

Conceptual Framework

The conceptual framework for my research reflects the philosophy of learning called constructivism and is drawn from the literature of educational change in technology, specifically that related to (a) teacher "adoption" of technology, (b) computer use in schools, (c) professional development for teachers, and (d) student role in teacher learning. The technological revolution within classrooms involves not only a change in the amount of hardware and software available, but also a revolution in teaching practice. As in any systemic change, in order for meaningful innovation to happen in schools, teachers must feel a personal connection to what is occurring and they must see classroom-related benefits to changing their teaching practice.

Teachers, schools, and school authorities go through stages on their journey to effective technology integration in the schools. Moersch (1994) suggests that teachers move through several stages in technology implementation, from non-use, to awareness and, finally, to effective integration involving higher order thinking skills. Effective professional development must be in place in order to advance teachers to a place where teachers readily and easily use technology in order to have a positive impact on student learning.

To understand the stages of implementing technology at a personal level and to learn what constitutes effective computer use, teachers need professional development designed to transform practice. In order for this to happen, professional

development needs to be related to the curriculum and offer ongoing support and follow-up. Professional development focus needs to vary depending on the level of the teacher, and support can come from administration, outside experts, and other teachers. As well, there is another group of supporters that teachers may find to be the most effective resource of all, and that is their students.

Constructivism

Constructivism may be the most significant trend in education relative to the dynamics of how teachers teach and how students learn (Marzano, 1992; McLelland, Marsh & Podenski, 1994). Constructivism is a theory about the nature of knowledge. There are different interpretations of constructivism, but most definitions centre around the idea that knowledge is created by people and is influenced by their values and culture (Phillips, 1995). In cognitive constructivism, the teachers' role as a facilitator is to pose authentic problems to children in what Jonassen, Peck and Wilson (1999) call a constructivist learning environment. Reibel, Wood, and Hogan (1994) describe constructivism as a collection of theories and ideas about the kinds of instruction and school experiences that lead to engaged learning. According to Johnson and Cooley (2001), when students become engaged in their learning experiences, "their learning naturally shifts to a multidisciplinary focus, requiring them to make new connections, synthesize information, and develop new constructs" (p. 12).

Jonassen, Peck, and Wilson (1999) believe that fundamental differences exist between constructivist and traditional views of learning. They believe "that

constructivist views of making meaning necessarily engage different kinds of thinking. In order to engage different kinds of thinking, we must rethink the ways that we use technology in our teaching"(p. 6). Table 1 contrasts the fundamental differences between constructivist and traditional learning (Jonassen, Peck & Wilson, 1999, p. 7).

Table 1
Comparison Between Traditional and Constructivist Learning

	Constructivist	Traditionalist
Knowledge	Constructed, emergent, situated in action or experience, distributed	Transmitted, external to knower, objective, stable, fixed, decontextualized
Reality	Product of mind	External to the knower
Meaning	Reflects perceptions and understanding of experiences	Reflects external world
Symbols	Tools for constructing reality	Represents world
Learning	Knowledge construction, interpreting world, constructing meaning, ill-structured, authentic-experiential, articulation-reflection, process-oriented	Knowledge transmission, reflecting what teacher knows, well-structured, abstract-symbolic, encoding-retention-retrieval, product-oriented
Instruction	Reflecting multiple perspectives, increasing complexity, diversity, bottom-up, inductive, apprenticeship, modelling, coaching, exploration, learner-generated	Simplify knowledge, abstract rules, basics first, top-down, deductive, application of symbols (rules, principles), lecturing, tutoring, instructor derived and controlled, individual, competitive

In the United States, constructivism has become the basis for reforms in several subject matter disciplines. The U.S. National Council of Teachers of Mathematics (NCTM) calls for mathematics classrooms where the construction of learner-generated solutions and algorithms is stressed rather than drill and practice to get the "right" answer. Similarly, the U.S. National Committee on Science Education

Standards and Assessment has called for science education reform based on experimentation and learner-generated inquiry, investigations, hypotheses, and models, and the National Council of Teachers of English (NCTE) has called for emergent literacy, based on constructivism, as an important thrust in language arts reform. In Canada, as well, constructivist philosophies are the basis for curricular reform. English Language Arts curricula across Canada, for example, emphasize metacognition and the creation of knowledge through critical thinking and language learning. Similarly, the new high school mathematics curriculum in Alberta includes student-centred problem solving, experimentation and student-centred inquiry.

Based on the findings of the U.S. North Central Regional Educational Laboratory's (NCREL) "Plugging In" project, technology integration that supports outmoded, teacher-centred educational systems is counterproductive (Jones, Valdez, Nowakowski, & Rasmussen, 1995). These researchers also suggest that the only authentic way to gauge the effectiveness of technologies is to examine the extent to which they encourage and make provision for engaged learning and collaboration on the part of the students. Teachers require educating, not simply training, on educational technology (Caverly, Peterson & Mandeville, 1997). This education involves collaborative guided practice in a supportive environment so that teachers can appreciate how technology impacts and benefits student learning.

Brooks and Brooks (1993) provide five principles of constructivist pedagogy: (1) posing problems of emerging relevance to learners; (2) structuring learning

around "big ideas" or primary concepts; (3) seeking and valuing students' points of view; (4) adapting curriculum to address students' suppositions; and (5) assessing student learning in the context of teaching.

Brooks and Brooks (1993) describe constructivist teachers as facilitators of learning and empowerers of students engaged in problem solving. They identify eleven characteristics of constructivist teachers.

1. Constructivist teachers encourage and accept student autonomy and initiative.
2. Constructivist teachers use raw data and primary sources, along with manipulatives, interactives, and physical materials.
3. When framing tasks, constructivist teachers use cognitive terminology such as "classify," analyze," "predict," and "create."
4. Constuctivist teachers allow student responses to drive lessons.
5. Constructivist teachers inquire about students' understandings of concepts before sharing their own understandings of those concepts.
6. Constructivist teachers encourage students to engage in dialogue, both with the teacher and with one another.
7. Constructivist teachers encourage student inquiry by asking thoughtful, open-ended questions and encouraging students to ask questions of each other.
8. Constructivist teachers seek elaboration of students' initial responses.
9. Constructivist teachers engage students in experiences that might engender contradictions to their initial hypotheses and then encourage discussion.
10. Constructivist teachers allow wait time after posing questions.
11. Constructivist teachers provide time for students to construct relationships and create metaphors.

When students collaborate in cooperative learning groups, which reflect constructivist philosophy, they share the process of constructing their ideas with others. With the improved access to the World Wide Web, students' cooperative

classroom becomes the world. In this setting, students view each other as resources rather than competitors and a feeling of teamwork ensues. These processes have resulted in advances in student learning (Resnick & Klopfer, 1989; Steffe & Gale, 1995).

Dwyer, Ringstaff and Sandholtz (1991) and Jonassen, Peck, and Wilson (1999) agree that teachers who use technology effectively tend to be comfortable with learner-centred classrooms. These teachers see their use of computers shift from an emphasis on isolated use of drill and practice software to a constructivist orientation and an expanded view of technology as a process where the emphasis is on computers used as tools to help students find viable solutions to real-world problems. "Technologies should be used as engagers and facilitators of thinking and knowledge construction" (Jonassen, Peck & Wilson, 1999, p. 13).

Teacher Adoption of Technology

As the use of technology changes teachers' beliefs and practices, teachers evolve along a continuum of technology integration that leads to increasingly effective instructional practices (Johnson & Cooley, 2001; Moersch, 1995). From a constructivist perspective, in order to implement technology outcomes, there are principles of pedagogy that must be considered including posing authentic problems of relevance to learners and assessing children's learning based on analytical thinking and performance (Brooks & Brooks, 1993). Professional development can facilitate teachers in moving their instructional focus toward a constructivist framework. However, the researchers quoted above point out that much professional development

is based on two faulty assumptions: (a) that participants will make connections between the technology they have available and their instructional curricula, and (b) that participants are ready and willing to initiate change in their instructional practices.

Several researchers have suggested approaches to bridge the gap between technology use and instruction and to provide a structured approach to staff development and technology planning. Moersch (1994) found that: (a) staff development opportunities for teachers to explore the potential of computer technology were oftentimes insufficient and misdirected, (b) most computer technology was used for isolated activities unrelated to a central instructional theme, concept, or topic, and (c) the use of the computer was often one step removed from the classroom teacher in that the computers were housed in a separate lab or the use of the computers required engaging the help of a technical person to log on or to set up. He also found that staff development sessions often led to non-use or low levels of use of the technology by the classroom teacher because the technology-based intervention did not reflect the teacher's instructional level (Moersch, 1994). Moersch created an instrument that measured **L**evels **o**f **T**echnology **I**mplementation, or LoTi, to assist school districts in restructuring their staff's curricula to include concept/process-based instruction, authentic uses of technology, and qualitative assessment. LoTi is aligned conceptually with the work of Thomas and Knezek (1991) and of Dwyer, Ringstaff, and Sandholtz (1992).

Moersch's Level of Technology Implementation (LoTi) questionnaire is designed to determine the level of a classroom teacher's technology implementation

by generating a profile for the teacher across three specific domains of technology implementation: level of technology implementation (LoTi); personal computer use (PCU); and current instructional practices (CIP). The PCU profile assesses each classroom teacher's comfort and proficiency with microcomputers (e.g., troubleshooting, simple hardware problems, using multimedia applications). The CIP profile reveals the teacher's inclination toward instructional practices that are consistent with a learner-based curriculum design. Moersch's Levels of Technology Implementation (LoTi) Scale outlines the stages of instructional practices needed for full technology integration/implementation (see Table 2). The LoTi questionnaire can generate information about each teacher's CIP, PCU, and LoTi and thus help professional development leaders target specific follow-up interventions that address each classroom teacher's current IT needs. In this way, an overall staff-development program can be increased in efficiency and effectiveness. Moersch has found a statistically significant correlation among students' academic achievement, the amount of professional development, and a teacher's LoTi rating.

Another model that explains the ways teachers structure instruction as they move toward technology integration has been designed by Valdez et al. (1999). In this model, teachers move from (a) automation, where technology is little more than an electronic worksheet, to (b) expansion, where students become more actively engaged in searching for information, and finally to (c) data-driven virtual learning, where students engage in authentic project/problem-based learning and assume responsibility for managing their own learning. Effective professional development is essential at each level.

Table 2
LoTi Scale (Moersch, 1995)

0. Non-use	A perceived lack of access to technology-based tools or lack of time to pursue electronic technology. Existing technology is primarily text-based (e.g., ditto sheets, overhead projector).
1. Awareness	Computer-based applications have little or no relevance to the individual teacher's instructional program. The use of computers is one step removed from the teacher (e.g., integrated learning system labs, special computer-based pull-out programs, computer literacy classes, central word-processing labs).
2. Exploration	The electronic technology is employed either as an extension to activities or as enrichment exercises to the instructional program. Technology based tools serve as a supplement to existing programs (e.g., tutorials, educational games, simulations).
3. Infusion (minimum acceptable level)	Technology-based tools including databases, spreadsheets, graphing calculators, multimedia programs, desktop publishing, and telecommunications augment selected instructional events.
4a. Integration (Mechanical)	Technology is perceived as a tool to identify and solve authentic problems related to overall theme or concept. Heavy reliance is placed on pre-packaged materials and sequential charts that aid the teacher in the daily operation of the instructional classroom.
4b. Integration (Routine)	Technology-based tools are readily integrated in a manner that provides rich context for students' understanding of pertinent concepts, themes, and processes. Teachers can readily integrate with little intervention from outside resources.
5. Expansion	Classroom teachers actively elicit technology applications and networking from business enterprises, governmental agencies, research institutions, and universities to expand students' experiences directed at problem solving and issues resolution. Technology access is extended beyond the classroom (e.g., contacting NASA to establish a link to orbiting space shuttle via Internet).
6. Refinement	Technology provides a seamless medium for information queries, problem solving or product development. Students have ready access to and a complete understanding of a vast array of technology-based tools to accomplish any particular task. Technology is perceived as a process, product (e.g., invention, patent, new software design), and tool towards students solving authentic problems related to "real-world" problem or issue.

Computer Use in Schools

"Leaping into the knowledge age appears to be less about technology integration *per se*, and more about the fundamental changes to teaching and learning" (Jacobsen, 2001, p. 3). For example, Goldman-Segall (2000) describes how students

using digital media become knowledge producers rather than knowledge consumers. Unlike the predominantly top-down use of media in the past, digital technologies enable students to share understandings through animation, graphics, and webpages. This use of these technologies promotes the idea of the learner constructing and requires a change in teaching practice.

Other researchers (see, for example, O'Neil, 1995; Stoddard & Niederhauser, 1993) state that using technology has moderate impact on student learning if used in a linear teacher-centred environment, and that change in practice is necessary. Moersch (1996) states that in changing practice, schools as well as teachers go through stages in the journey from teacher-centred to learner-centred environments, and as a school site progresses from one level to the next, a corresponding series of changes to the instructional curriculum is observed. The focus of instruction changes from a teacher-centred to student-centred orientation (Moersch, 1996).

Based on his LoTi framework, Moersch developed an instrument designed to measure what he terms "computer efficiency" at the school site level. This computer efficiency tool is designed so that "primary emphasis is given to the degree that technology is given to support a constructivist orientation to classroom pedagogy based on available hardware and software at the school site" (p. 52). Table 3 (Moersch, 1996) shows three developmental levels and the changes that occur in instructional practices as a school site changes its orientation.

Table 3
Levels of Instructional Practices (Moersch, 1996)

	Level 1	Level 2	Level 3
Learning Materials	Organized by the content: Heavy reliance on textbook and sequential material	Emphasis on science kits; hands-on activities	Determined by the problem areas under study; extensive and diversified resources.
Learning Activities	Traditional verbal activities; problem solving activities.	Emphasis on student's active role; problem solving activities with little or no context.	Emphasis on student activism and issues; investigations and resolutions; authentic hands on inquiry related to a problem under investigation; focus on experiential learning.
Teaching Strategies	Expository approach	Facilitator; resource person	Colearner or facilitator
Evaluation	Traditional evaluation practices, including multiple choice, choice, short answer, and true/false questions.	Multiple assessment strategies, including performance tasks and open-ended questions.	Multiple assessment strategies integrated throughout the unit and linked to the problem/theme/topic; portfolios, open-ended questions, self-analysis, and peer review.
Technology	Computer-based drill and practice programs. Little connection between technology use and overall theme or topic.	Technology integrated into isolated hands-on experience (e.g., the tabulation and graphing of data to analyze a survey or experiment); information searches using telecommunications	Expanded view of technology as a process, product, and tool to find solutions to authentic problems, communicate results, and retrieve information.

Professional Development for Teachers

It is important that professional development organizers realize that teachers' beliefs and practices change slowly, and that these changes need to be supported (Dwyer, Ringstaff & Sandholtz, 1991; Moersch, 1998). Both Moersch and Dwyer and his colleagues have outlined a series of staff development interventions designed to

advance teaching staffs to higher levels of technology use. To be most effective for teachers, this professional development must include: (a) connections between technology and curriculum; (b) activities designed to move teachers to a change in teaching practice; and (c) support for teachers

Connecting Technology and Curriculum

Teachers and professional development planners agree that the most effective professional development training in technology includes hands on, curriculum-related activities. Training in technology must be organized in ways that enable teachers to think first about their curricular needs and then about how to integrate the technology into the curriculum (Guhlin, 1996; Valdez et al., 1999).

Unfortunately, teachers often are offered professional development opportunities focused on learning how to use a spreadsheet or a wordprocessor in isolation, with no connection to everyday practice (Abdal-Haqq, 1998; McKenzie, 1999).

To be most successful in infusing technology with present curricula, teachers need specific recommendations for technology integration based on expanding and advancing present practices (Jones, Valdez, Nowakowski & Rasmussen, 1995; Office of Technology Assessment, 1995). Slough and McGrew-Zoubi (1996), in a study focusing on teachers creating their own Web materials, found that the most effective training for teachers included hands-on resources that would be integrated into the curriculum and that the effect of hands-on training went far beyond the training's immediate goals. They found that effective training also altered the way teachers thought about teaching and technology. Gibson and Oberg (1999), agree with Slough

and McGrew and, in two studies involving teachers learning how to use the Internet, found that "linking the training to classroom projects works well because the teachers' learning can be applied immediately to classroom needs" (p. 5).

Change in Teaching Practice

Effective staff development activities focus on in-class relevance and lead to changes in teaching practices. Jonassen, Peck and Wilson (1999) argue that using technology in traditional ways does not maximize student learning. They claim that learning with technology will only be meaningful when "technologies engage learners in (a) knowledge construction, not reproduction, (b) conversation, not reception, (c) articulation, not repetition, (d) collaboration, not competition and (e) reflection, not prescription" (p. 16).

In Alberta, the implementation of the new Information and Communications Technology (ICT) curriculum was mandatory in 2002. The intent of the ICT learning outcomes is that students should have the knowledge, skills and attitudes that will serve them well for entry-level work, for further study, and for lifelong learning and that these attributes will serve them well as they strive to become inquisitive, reflective, discerning and caring persons (Alberta Education, 1998). With respect to fundamental understandings, students must be prepared to understand, use and apply technologies in effective, efficient and ethical ways. Technology integration is meant to be cross-curricular, not treated as a course or topic in and of itself. The role of technology in schools is receiving a great deal of attention from Alberta Learning. Teachers are being asked to be facilitators rather than distributors of knowledge as

instructional focus shifts from a teacher-centred to a learner-centred orientation (Alberta Learning, 2002).

Teachers who use technology effectively tend to be comfortable with learner-centred classrooms (Dwyer, Ringstaff & Sandholtz, 1991; Moersch, 1998; Jonassen, Peck, and Wilson, 1999). Johnson, Schwab, and Foa (2000) studied the impact of technology on teaching practices. Their research team worked with more than 200 schools across the United States as teachers implemented major technology projects in their classrooms. The researchers discovered that the technological revolution that is so touted indeed has the potential to do a great deal more than change the form of educational content from paper to electronic media. They reported:

> We have observed scores of teachers who are demonstrating that the technological revolution has the potential to provide the impetus, the tools, and the new structures to transform the practice, the art, and the meaning of teaching. We have observed that as teachers move past the early stages of technology adoption, their classroom content tends to move beyond the confines of the textbook and lecture methodologies. These teachers become more open to peer interaction and seek more student involvement in curriculum and student assessment decisions. They tend to use more collaborative and team structures for organizing students. In addition, the frequency and depth of classroom innovation increases with the more technology integration they achieve. (Johnson, Schwab, & Foa, 2000, p. 8)

Support for Teachers

Teachers need support in using technology and, most importantly, in integrating technology with effective pedagogy. "Teachers must be given support if they are to challenge deeply held beliefs about education and technology and if they are to construct new ways of viewing technology in education" (Dwyer, Ringstaff & Sandholtz, 1991, p. 47). One method of support is mentoring. Moersch (1998)

suggests encouraging teachers who are working at higher levels on the LoTi scale to design units that can be shared with others within the school or school district. This type of support "may improve these teachers' perception of their ability to integrate technology and also move them to a higher level of integration" (p. 41). Brown and Henscheid (1997) agree that opportunities to peer coach and tutor as well as ongoing support from administration and others are essential to adoption of technology initiatives.

Gibson and Oberg (1999) found that teachers benefited from various kinds of support as they learned to use the Internet. "The teachers in the school-based projects most often identified the following as supporting factors for learning about the Internet: administrative, technical, and parental support; opportunities for collegial sharing; being able to learn within the context of something relevant; and having a positive attitude toward change" (p. 5). Edwards (2002) agrees and states that "Internet technology offers significant educational opportunities for both the student and the teacher. However, the challenge for the K-12 classroom teacher is to appropriately integrate Internet technology into the instructional program" (p. 13).

A growing consensus about what makes professional development effective highlights the need for peer coaching within a collaborative work culture and a learning community (North Central Regional Education Laboratory, 2000). Schools need to create learning communities by linking professional development to the work teachers are doing in their classrooms each day and by peers modeling effective classroom instruction, defined as an inquiry-based approach to teaching and learning.

Surveys of teachers have repeatedly demonstrated that, in integrating technology, teachers tend to look first to others in their school for guidance, advice and training (Web-Based Education Commission, 2001). Peer coaching provides job-embedded professional feedback and support. Research indicates that school-based peer coaching plays an important role in improving teachers' abilities to adopt and implement new learning practices; teachers need time during the school day to observe new strategies being modeled, and they also need opportunities to develop new units and to engage in hands-on experiences in implementing new skills (Guhlin, 1996; Yocam, 1996).

Showers and Joyce (1996) found that fewer that 10% of teachers implement new ideas that they learned in traditional training settings such as workshops. The problem with these traditional approaches, they insist, is that teachers often have no ability to apply what they learn in these workshops, and no way to receive feedback when they do attempt to apply what they have learned (Showers & Joyce, 1996). In a study of several schools that had adopted a peer coaching model, Showers and Joyce found that when teachers combined participating in typical workshops with peer coaching for sharing and observation, 88 % of teachers were using new strategies in their classrooms effectively.

Other researchers in the field of professional development agree that peer coaching and study groups that provide opportunities for on-going discussion and reflection "may have more influence on changing teaching practices" than other professional development strategies (Darling-Hammond, 1997; Hargreaves & Fullan, 2000; Little, 1993; Richardson, 1999).

Research also indicates that peer coaching can play an effective role in helping teachers to integrate technology into their classrooms in ways that encourage active learning by their students. Studies show that peer coaching has been used successfully over extended periods to help teachers at all levels of technology implementation to develop technology applications that promote engaged learning (Yocam, 1996; Norton & Wilburg 1998).

Student Role in Teacher Learning

Although at present there is very little literature on students' role in curricular change or in their role in the learning of their teachers, one researcher, Holzberg (1997) states "there is no better way to implement staff technology training than by rallying students to the cause" (p. 34). Marcowitz, Hanza, and Farrow (2000) investigated how students supported their teachers when technology was used in the classroom; they reported that "support for technology in schools comes from a variety of sources. One area that is often overlooked is the support teachers get from their students" (p. 214). These researchers conducted a case study in a public elementary school in the American Midwest; they interviewed three teachers and observed them in a classroom setting. Findings from the case study showed that students gave teachers support in five main categories, the most significant ones being in (a) teaching, (b) becoming an expert, and (c) other activities including helping teachers learn. The researchers stated that "these were the most significant categories of support because the teachers were able to change their curricula in ways that might not have otherwise been possible" (p. 224).

One teacher participant observed that having a core of experts at a close proximity is difficult without using students for support. Creating a core of student experts who in turn could assist the teacher was found to be beneficial to the students being taught, to the students doing the teaching, and to the teacher (Marcowitz, Hanza & Farrow, 2000). The study also found that "teachers get support by learning with students" (p. 223). This support by students was observed when teachers gave students in-class time to learn the technology on their own and, while the students explored, the teachers felt free to learn along side the student. Although this study differs from my proposed study, which involves students teaching teachers in a structured setting, this study does provide understanding about how the integration of technology is affecting student roles.

Caverly, Peterson & Mandeville (1997) used a peer coaching model for educating teachers in technology use. In this model, more experienced teachers passed on their expertise, to teachers unfamiliar with technology integration, in a hands-on environment. The researchers found that, after teachers had integrated technology into their curricula, "teachers were giving up control in the classroom, letting students teach one another and teach the teacher. Teachers developed confidence and tolerance for ambiguity" (p. 58).

Conclusion

Today technology use in curriculum is viewed, not as a tool for improving the efficiency of traditional instructional methods based largely on the transmission of isolated facts and skills from teachers to students, but rather as one element of a

constructivist approach in which teachers concentrate on helping students to actively construct their own knowledge (Jonassen, Peck & Wilson, 1999; Means, 1994; Moersch, 1995). In order for students to learn *with* technology, it is important to educate teachers about new models of teaching and learning. In using technology, the teachers' primary responsibility changes from a purveyor of knowledge to that of a coach so that students are able to construct their own meaning.

Teachers need support as they learn to use technology to involve their students in meaningful, engaged learning projects (Jonassen, Peck & Wilson, 1999). A strong support for teachers as they learn to be effective users of technology in their classrooms may be the students themselves.

Chapter Summary

The literature suggests that teachers and schools go through stages as teachers integrate technology into their classrooms. The literature also suggests effective professional development that enables the process of technology integration. Research also indicates that a change in teacher practice is necessitated by the integration of technology, and that learning becomes more effective when teachers move to a constructivist classroom orientation. Although scarce, available literature indicates that students may assume a valuable role in the learning of their teachers as schools adapt to curriculum changes in technology integration.

CHAPTER THREE

METHODOLOGY

Purpose

The intent of this qualitative study was to develop deeper understanding of the experiences of teachers and students as they participated together in a technology-related professional development activity. The study examined the participants' interactions, reactions, and reflections as students assisted teachers in technology-related learning.

Research Approach

My study was a qualitative research study, "an inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting" (Creswell, 1994, p. 2). My approach to the study followed what Lincoln and Guba (1985) were among the first to term an interpretive or naturalistic approach--an inductive approach, concerned more with process than with outcomes.

Naturalistic inquiry leads to the development of an ideographic knowledge base, that is, one focusing on the understanding of particular events (Lincoln & Guba, 1985). Interpretive inquiry was appropriate to the goal of this study, which was to develop understandings of a specific type of professional development experience. Although I had outlined a basic structure for my research, the research design continued to emerge as the study progressed. As Guba and Lincoln (1981) stated,

"naturalists . . . will insist on emergent design which is never completed until the inquiry is arbitrarily terminated as time, resources, or other logical considerations might dictate" (p. 79).

Five axioms or assumptions of qualitative research (Creswell, 1994) guided the design of my study:

1. The ontological assumption: Reality is constructed by the participants in the research situation. As a researcher, I acknowledged the existence of multiple realities and recognized that knowledge is relative and context-bound (Denzin & Lincoln 2000).

2. The epistemological assumption: The researcher and those being studied are in an interactive process with each influencing the other; the researcher does not try to distance himself or herself from the study. I opted for a "personal, interactive mode of data collection" (Mertens, 1997).

3. The axiological assumption: The researcher is "value laden and biased" (Creswell, 1994, p. 5). The researcher is the data-collecting instrument, and meaning is mediated through this instrument. My experiences and beliefs played a part in shaping the study.

4. The rhetorical assumption: The research adopts an informal, personal voice and decisions evolve throughout the study. In my study, the juxtaposition of ideas led to new ideas and interpretations that were reflected upon as they emerged.

5. The methodological assumption: The research involves the inductive process. "Interviews, observations, and document reviews are predominant in this paradigm" (Mertens, 1997, p. 14). The methodology for my study was designed to seek understanding and to "lead to patterns or theories that help explain a

phenomenon" (Creswell, 1994, p. 7). The study was influenced by context, and the design emerged throughout the study.

Selection of the Research Site

The two schools chosen for the study were located in a rural school district in Alberta. The district had a technology plan in place that included a district-wide network, e-mail accounts for all students, and networked computers for all schools. Many teachers, however, were using the technology for routine drill and practice or simple web searches with little or no focus. Teachers felt that they needed to learn how to use the Internet effectively in their lessons.

The first professional development activity was held in a grade 7 to 12 school with 400 students, and the second in a small school that included 180 students from kindergarten to grade 12. The students in the study were all at a grade nine level. In both schools there were some teachers who had assumed leadership roles in district technology implementation, and both schools were equipped with a functional network and new computers. The teachers in the schools ranged from those who used computers only for administrative tasks and word-processing to a few who were highly skilled. During the 2001-2002 school year, an Alberta Initiative for School Improvement (AISI) project in the schools challenged teachers to integrate computers into the curriculum in order to encourage students' higher order thinking skills. I was the AISI coordinator in charge of facilitating the projects. Teachers initially had been willingly to participate in collaborative projects, but they were increasingly becoming frustrated because they themselves lacked the skills their students needed to complete the projects.

One-day professional development activities were available to teachers through the regional professional development consortium. This consortium offered an abundance of one-day workshops primarily targeted at using particular software or applications. However, the sessions were costly and often not relevant to immediate tasks needed to complete current classroom projects. A variety of new professional development activities began to appear that focused on in-class projects, including the activities that included students as co-learners or as student instructors to the teachers.

Situating the Researcher

In qualitative research, the researcher is the primary instrument in data collection, rather than some non-human device (Bogdan & Bicklen, 1992; Eisner, 1991; Denzin & Lincoln 2000). In this study, as a qualitative researcher, I was a seeking an insider's point of view; I was not an objective, politically neutral observer (Denzin & Lincoln, 2000).

In 1994 I completed a Masters' thesis about teachers and teacher-librarians working together in an instructional setting. The benefits of such collegial experiences to teachers included (a) increased talk about teaching and learning, (b) increased energy levels, (c) increased benefit for students, and (d) increased support for teachers as they changed instructional practices. I believed that, by students working with teachers in a collaborative environment, similar benefits might be possible. I realized that as I observed and interviewed I was taking these values and biases to the study and that these values and biases may have shaped the study.

As well, the research process was shaped by my professional history that included many years as a teacher-librarian and as a coordinator of technological change and changing teaching practices, both at school and regional levels. During that time, I worked closely with one school staff as a teacher-librarian and colleague, and with other school staffs in the implementation of Alberta Learning's Information and Communication in Technology (ICT) outcomes and of various Alberta Initiative for School Improvement (AISI) projects. As a result, I was personally acquainted with the teacher and student participants of the study and was known respectively as their colleague or teacher. I believe that acquaintanceship strengthened the study, not weakened it. I felt that my acquaintance with the selected participants enhanced my effectiveness in establishing an effective interview setting, especially in the important areas of gaining access, identifying the participants, and gaining trust and rapport (Fontana & Frey, 2000). However, my personal experiences with the participants have been extremely positive and primarily collaborative, and, because of that ready rapport, I needed to be alert to unique and unexpected experiences. At the time of the study, I had been out of the schools as a staff member and AISI project teacher for almost a year, giving me the value of some distance and time.

Participant Selection

As teachers implement technology into their classes, they increasingly have become coaches and facilitators. Often, so that students effectively learn *with* technology, teachers feel the necessity to learn more about using an application or applying a technological skill. The professional development activity set up in order

for teachers to attain a specific goal was one arising from a curricular need, and one in which students were involved as instructors to the teachers. The students involved in the professional development activity were all grade nine students identified by their computer teacher as being able to demonstrate a high degree of technological skills. In both study sites, the students volunteered to be the student instructors. Each teacher participant had a role in the ongoing cross-curricular Telus 2learn project, or was working on a particular assignment in class. In the Telus 2learn project, grade nine students analyzed and categorized local and school garbage and devised an action plan for waste reduction. Technology was used in the data analysis and in the presentation of findings.

The principal and the assistant principal in one school participated in both the Telus 2learn project and in the professional development activity. Some teacher and student participants knew each other very well, while others were working together only in the project. The student instructors and teachers interviewed in the study were not necessarily partners; for example, the teachers whom Cody and Allison instructed were not interviewed, nor were the students who were teaching Ms. Hamilton and Mrs. Blairmore.

Based on what I felt would best represent a "purposive sample" (Stake, 2000, p. 446), I invited eight student instructors and eight teachers from one school and five student instructors and five teachers from the second school to participate in my study. All thirteen teachers and thirteen student instructors initially agreed, and I talked informally to all. From these, I chose five teachers and five students to participate in the in-depth interview and follow up interviews needed for the study.

The participants selected were those whom I felt were both articulate and reflective and were likely to be able to provide insights needed for the study.

Data Collection

"Qualitative researchers deploy a wide range of interconnected interpretative methods, always seeking better ways to make more understandable the worlds of experience that have been studied" (Denzin & Lincoln, 1994, p. 12). Data collection for my study involved a variety of methods, including observation and semi-structured interviews. Also, I kept a research journal to record both descriptive and reflective notes.

Observation of the professional development activity helped me "understand a particular . . . event, role, group, or interaction" (Locke, Spirduso & Silverman, 1987, p. 39). While observing the professional development activities, I observed energetic interaction "in a natural setting where human behavior and events occur" (Creswell, 1994, p. 162). Through observation and journaling, I paid "attention to particulars" and "focused on the process that was occurring as well as the product or outcomes" (Cresswell, 1994, p. 162). In this study I considered myself to be a participant observer who "usually wants to interact with the participants while collecting data from them" (Mertens, 1997, p. 317). During the study I found myself engaged in "moderate participation" and was mindful of Patton's (1990) suggestions of effective observation, paying particular attention to (a) physical setting, (b) human and social environment, (c) participant behaviors, (d) informal interactions and unplanned activities, and (e) observing what does not happen.

Interview data were collected on audiotape through semi-structured interviews, and follow-up interviews occurred with selected participants. Participants were asked to not only recount their experiences, but also to engage in reflection. Van Manen (1997) indicates that the interview process "needs to be disciplined by the fundamental question that prompted the need for the interview in the first place" (p. 66). The interviews were guided by a semi-structured interview schedule (Appendices C and D), but the interviews were conversational in nature so that emphasis was actively shaped by participants' perceptions and experiences.

Each interview began with a relaxed conversation where we talked of the school, the professional development day and technology in general. I reviewed the nature of the study and restated assurances of confidentiality. I then asked open ended questions which allowed each participant the opportunity to share his or her understandings and insights. Some initial responses grew into rich descriptions of the participant's experiences during the professional development activity. Although the same initial questions were asked of all participants, I realized that each interview created its own shape and that each participant had his own unique role in determining what was shared.

Interviews took place in the first school in the office adjoining the library. In the second school, the interviews took place in a classroom. The situations were relaxed and the participants were familiar with the environment and seemed comfortable with the location. I kept a reflective log of personal observations and insights throughout the study. The log, initially kept in a research journal, quickly included ideas and insights that I scribbled in my day planner, on agendas of

meetings, and on handouts given by speakers at conferences. Many times throughout the year I found myself learning from other work-related situations involving teaching and learning, and I began connecting these insights to initial understandings from the study.

Data Analysis

"In qualitative analysis, several simultaneous activities engage the attention of the researcher: collecting information from the field, sorting information into a story or picture, and writing the qualitative text" (Creswell, 1994, p. 153).

Janesick (2000) describes inductive analysis as a five-step process including (a) immersion in the data, (b) incubation, (c) illumination (d) explication, and (e) creative synthesis. Upon reflection, I realize that I was never wholly in one stage at a time and the process for me was recursive rather than linear; however, in order to arrive at a place where I felt I could confidently share my findings, I had indeed experienced all five stages.

In the *immersion* stage I listened to the tapes and chose one to be professionally transcribed. I shared this first transcript with my both advisor and my auditor, a friend and mentor who had recently completed her PhD. With these two people, I was able to share my initial thoughts and receive feedback. I then sent the additional tapes to be transcribed, and upon their return, I read each transcript and listened to the tapes a second time. During the *incubation* stage I thought about the data and in my mind continually connected these thoughts to research literature and to work-related situations. At this time, I was also teaching EDES 545 "Information

Technologies for Learning" for the University of Alberta's Department of Elementary Education. I kept recognizing that some of the ideas expressed in the participants' transcripts related to and sometimes illuminated or extended course content.

The third stage, *illumination*, engaged me in a holistic, inductive review of the content of the data looking for patterns and interconnected insights, both within and across transcripts. By using "insight, intuition, and imagination to draw inference" (Guba & Lincoln, 1989, p. 42), I categorized data into themes in order to provide further understanding.

I began analyzing the text by using Nvivo software, which is a tool to assist the qualitative researcher in developing categories, concepts, and ideas from the data. The first phase was the creation of nodes, which are containers for topics, ideas, categories, or any other thoughts that occur while reading the data. *Free nodes* were used as containers to gather ideas that did not fit into a larger category whereas *tree nodes* were used to gather items that led themselves into sub-categories or themes. The greatest "illumination" happened, I believe, when I began to link the free nodes into patterns or tree nodes. Here the interconnectedness of insights became evident, and I began to see the emergence of strands of meaning, patterns, and, eventually, themes. The actual writing and re-writing of the descriptive stages and findings of the study reflected Janesick's fourth stage, that of *explication.* I found in this stage that I was constantly circling back to the first three stages and was constantly re-reading, thinking, puzzling, and coming up with additional "ah-ha"s.

The fifth and final stage, that of *creative synthesis*, connected ideas from the findings to ideas about present and future pedagogy involving the use of technology

in schools and in teacher preparedness for this change in teaching practice. These thoughts are presented in Chapter Five.

Trustworthiness

The results of this study should serve as a useful reflection of the experiences of the participants, interpreted in a way that provides opportunities for insights of others who work with teachers and professional development in technology.

Lincoln and Guba's (1985) four classic criteria of trustworthiness are appropriate to this study. They are: (a) credibility, (b) transferability, (c) dependability, and (d) confirmability. Credibility refers to the researcher's authentic interpretations of the data and is often established by member checking. During the development of the research questions, the areas of exploration and the wording of the questions were discussed with members of my doctoral cohort group. I informally discussed emergent themes with three of the teacher participants in order to clarify understandings and to authenticate quoted passages. I then shared early findings with teacher and student participants who, in some cases, offered further insights and understandings. As a final step I sent a draft of Chapter Four to all participants and asked for final comments.

Transferability was provided through thick description of research events and contexts. This description possibly will enable other researchers to identify similar events and contexts in which these results might apply. I have identified major themes that emerged from the data "in order to facilitate transferable judgments on the part of

others who may wish to apply the study to their own situation" (Guba & Lincoln, 1989, p. 242).

Dependability refers to the likelihood of a particular research strategy yielding consistent results in similar situations. The compilation of a careful audit trail consisting of a research log, notes, and memos helped to provide this dependability. As well, files of collection procedures, records, notes, and raw data from telephone logs and transcripts are open to scrutiny by the supervisory committee.

Confirmability refers to the internal coherence and consistency of the research report and includes the recognition and confrontation of the researchers' assumptions and biases. Although there was no attempt to provide value-free results, several activities were undertaken to confront bias issues. Both confirmability and credibility were enhanced by the use of a research journal used for self-reflection and for the purpose of audit by a colleague and by my supervisor.

Limitations and Delimitations

There are six limitations to this study. First, the purposive approach to participant selection means that a small number of individuals were potential participants and they were all from one school district. The involvement of other teachers and students in Alberta has been excluded. Second, my personal involvement in collegial experiences with teachers in the district and my role in the district implementation of ICT outcomes may have resulted in an overly favourable portrayal of elements of the study. Third, my inexperience as a researcher may have limited my ability to fully interpret the meanings of the participants. Fourth, the study depended

on responses drawn from each participant's memory, which could be distorted or changed by time. Fifth, the study was limited by the willingness of participants to fully share their experiences. Sixth, the study was limited to two after-school professional development activities.

There are some intentional delimitations used to narrow the study. The study is limited to teachers learning technology by interacting with their students, which forms only a small piece of staff development in technology.

Assumptions

The main assumptions underlying my study are outlined below:

1. Teachers are insightful professionals who are able to richly describe meaningful activities involving technology.
2. Responses given by the participants indicate their beliefs about what the professional development activity meant to them.
3. Insight can be gained by studying the perceptions of five teachers and five students.

Ethical Considerations

Approval for the study was given by the Research Ethics Board of the Faculties of Education and Extension at the University of Alberta. The participating teachers and students chose to be part of the proposed study after the invitation had been issued both verbally and in writing. This invitation included an explanation of

both the purpose and nature of the research. Those interested in participating in the study as well as the parents of the students involved were given time to ask questions.

Prior to the study, teachers, parents, and students signed a consent form that explained the nature of the study and their rights in relation to the study. I also explained the study orally to the students and teachers and answered their questions. I invited the students' parents to phone me about any questions or concerns at any time during the study. The verbal explanation and the written consent forms indicated that participants could have opted out of the research at any time without penalty. I shared transcripts and drafts of the research report with the participants.

All participants have been referred to through the use of pseudonyms, and all data collected was kept in the sole possession of the researcher. Coding known only to the researcher and the supervisor was used when transcribing the material. Permission granting the use of data for presentations and written articles was part of the consent signed by the participants.

Finally, the individual preparing the transcriptions read the guidelines and was oriented by the researcher to the application of the study.

The Professional Development Activities

The first participants in my study were involved in a professional development activity that occurred in June of 2002 in the computer lab adjacent to the library at the first school in the study. The activity included eight teachers and eight grade nine students whose job it was to teach their teachers how to make webpages using Netscape Composer. The task evolved from a grade nine Telus 2learn Project

involving recycling in the school and community. The *Telus Leaning Connection* is an Alberta educational alliance that sponsors the *2learn.ca* website The alliance coordinates grassroots funding for school Internet projects. One of the requirements for project funding was the creation of a website by the students. As a direct result of being involved in this project, the teachers in the school expressed an interest in making webpages.

The students who were to be part of the professional development activity (see participant selection) met me briefly the day before the activity and were reminded to have their personal webpage ready to demonstrate. At that time they were told who their teacher partner would be and I explained to them a little of what to expect. Prior to the activity, which was to begin at 4:00 p.m., the students met me in the library for a brief "staff" meeting. Before the teachers arrived, the students and I reviewed the anticipated events and outlined procedures. We made a brief list of the skills that we thought the teachers might want to learn, which I posted in the lab. The students then went to their stations in the computer lab and waited for the teachers to arrive.

Teacher participants joined the students at 4:00 p.m. and were partnered with their student instructor. I welcomed everyone, indicated that the session was to take about two hours, and suggested that at times during the session we would stop and share progress. I also pointed out the posted list of skills that the students and I had created, but assured teachers that they need not follow the list. Students began by showing their "teacher partner" their own webpages, and asking the teacher what skill he or she would like to learn first. The goal was for each teacher to have a simple webpage on the World Wide Web by the end of the session.

Learning and teaching began. There were squeals of delight as headings, links, images, and animations began to appear. Twice I asked if everyone would like to stop and see the teachers' pages, but most were reluctant to leave what they were doing. Teachers were on task the whole evening--some took notes, and others articulated how they would use the page in their current project. Time flew.

Supper was arranged to arrive at 6:00 p.m.--barbecued hamburgers with all the trimmings. When I announced that we were ready to eat, no one moved from his or her station. I had to assure everyone that they would be able to continue learning after the meal. The activity ended with teachers and students sharing both grins and success stories. One teacher remarked, "I can't wait to get home and show my kids that I am on the World Wide Web!"

The second professional development activity occurred in April of 2003 in the computer lab of the second school in the study. The activity included four teachers, one library assistant, and five grade nine students whose job it was to teach their teachers how to use *Excel* in a current classroom project.

The day before the activity, the computer teacher had informed the student participants (see participant selection) the name of their teacher partner. Procedures were similar to the first professional development event in that, prior to the activity which was to begin at 4:00 p.m., the students met me in the teachers' workroom for a brief "staff" meeting. Before the teachers arrived, the students and I reviewed the anticipated events and outlined procedures. We made a brief list of the skills that we thought the teachers might want to learn and how these skills were applicable to the

current lesson. The students then went to their stations in the computer lab and waited for the teachers to arrive.

This event seemed to begin a bit slower than the first activity, but soon there were giggles and comments such as, "I can't believe I actually did that!" As in the first study, teachers were on task and were delighted as they found meaningful ways to enhance their current project by using *Excel.*

Supper in this school consisted of pizza delivered by the local café. Students and teachers alike grinned in satisfaction as they reviewed the night's events, and all agreed that time flew, and that they be ready for a follow-up at any time.

Chapter Summary

The study of teachers and students working together in a professional development activity followed the naturalistic paradigm of qualitative research. The inductive research design was concerned with process, meaning, description, and used the researcher as the primary data collection instrument. A purposive sample of participants was chosen. They were assured of confidentially and were active participants in the direction and shape of the interviews. Trustworthiness was enhanced by careful collection of data from several sources, the review of data by participants, and by providing audit records.

CHAPTER FOUR

FINDINGS

Introduction

This chapter presents the research findings from interviews with both students and teachers. The first part of the chapter presents student understandings related to instructing their teachers in a technology-related professional development activity. The student findings are followed by the understandings of teacher participants in the study. Both sections reflect participant reflections of the professional development activity as interpreted through an inductive analysis process. The findings are presented through descriptive themes related to the professional development experience as participants recounted them.

Table 4 clarifies roles and locations of teachers mentioned in the findings chapter.

Table 4
Teachers mentioned in the findings

Teacher	Description	Professional Development Activity
Mrs. Blairmore	Junior high teacher	Creating webpages
Mrs. Cardston	Junior-senior high school teacher	Integrating spreadsheets into core curriculum
Mr. Donovan	Junior-senior high school principal	Creating webpages
Ms. Hall	Junior-senior high school assistant principal	Creating webpages
Ms. Hamilton	Junior-senior high school teacher	Creating webpages
Mr. Sanders	Junior-senior high school teacher	Creating webpages
Mr. Vernon	Junior-senior high school teacher	Creating webpages
Ms. Winters	Junior and senior high school teacher	Integrating spreadsheets into core curriculum

Students

Students thought the experience of teaching their teachers at an organized professional development event was both interesting and rewarding. The students shared the experience by talking about their understandings of (a) interacting with a teacher, (b) teaching and learning, and (c) the rewards of the experience.

Student Understandings: Interaction with a Teacher

All five student participants delighted in describing the interaction with their teacher. The students described the initial meeting with their teacher partner and how their perception of that person changed because of the professional development activity.

Before each student response, I have included a brief description of the pairings, as I feel this description might clarify readers' understandings of the findings.

Cody

Cody's partner was Mr. Sanders, a CTS (woodworking, mechanics, graphics) teacher. Cody had had some issues with Mr. Sanders in class. He was apprehensive about his instructor and Cody described his initial apprehensions about being paired with the CTS teacher, and grinned as he explained what had happened.

> Oh, at the beginning it was kind of a funny story. At the very start of the day I was with a bunch of my friends, and one of my friends said something, and he (the teacher) thought it was me, so he kind of sent me to the office. And then at the end of the day I did do a whole bunch of webpage activities with him. (Cody, lines 72-77)

When asked how this incident had affected the relationship, Cody replied, "I wasn't really scared or worried. It was just kind of awkward knowing that he just kind of sent me to the office at the start of the day" (Cody, lines 79-80). Cody went on to explain, "After that we just kind of just got along and started talking. Didn't really affect anything that happened" (Cody, lines 82-83).

Cody described the teaching experience itself and at the end reflected upon his relationship with the teacher, Mr. Sanders.

> I didn't really hate him or anything before; I actually kind of liked him anyways, but I feel something changed. I was looking around at the other teachers. They all seemed really happy, and sometimes they're kind of miserable when they're in a class. (Cody, lines 275-280)

"He's the only teacher, I think, that he actually bought me my lunch on Friday last week. And all the other kids that were there, they were all like, 'Why wasn't our teacher buying us food?'" (Cody, lines 284-288).

Heather

Heather was paired up with Mr. Vernon, her science teacher. Although Heather had been in Mr. Vernon's class all year and was working with him in the project, she felt she didn't know him very well as a person.

Heather talked about her initial comfort level around her science teacher. " I feel comfortable around teachers, because I feel like I know them pretty well, because I have older siblings that were taught by them, and they knew me before they taught me (Heather, lines 378-379). She talked about the initial feeling she got from Mr. Vernon. "He probably was excited about working with a student and wondering how I would teach him" (Heather, line 395). Heather explained that at first, "I didn't think

I'd be very good at teaching him how to do it because I didn't know if I was that good at making a Webpage. But I guess it was okay" (Heather, lines 46-47).

Heather said she found out quickly that she knew more than Mr. Vernon did. "A lot more. I think I felt like they should have known more than they did, but it sort of surprised me" (Heather, line 49-50). She said that the realization made her feel "kind of smart" (Heather, line 51). However, upon reflection, Heather admitted that she wasn't surprised that he knew so little because she had learned how to do this in a computer class. "I wouldn't have known it if I hadn't taken a computer class" (Heather, line 53). About the relationship with Mr. Vernon, Heather said, "It was fun, and I think he really learned from it. I think he was a pretty fast learner (Heather, line 70-71). "It was sort of different to teach a teacher, and I felt more equal" (Heather, line 86). She thought that Mr. Vernon enjoyed being taught by a student because "It's more personal to have someone just for you, to teach you. So it was probably more comfortable than having someone else--and if you have to ask a question, it's just easier" (Heather, lines 104-105).

Heather went on to say that students are likely a good source of professional development for teachers.

> He'd probably feel better around the student because he'd probably feel more confident, because if he had to ask a question he wouldn't feel as embarrassed. Because he'd trust you. Now, some people might have thought the opposite, that he would be not willing to tell a student he *didn't* know something when he was a teacher. But he didn't feel that at all. (Heather, lines108-113)

Heather, when reflecting about the relationship with her teacher at the end of the experience, said "He was a lot more fun than I had ever seen him

before--he was more fun than I thought he would be" (Heather, lines 485-486).

Brendan

Brendan was paired up with Ms. Hall, the school's assistant principal, who had taught him only in a few brief team-teaching situations. He was unfamiliar with her level of expertise in technology and viewed her as the disciplinarian of the school. Brendan described his experience of being paired with the assistant principal. "We kind of had a list of choices, and then I sort of knew the teacher well because I kind of had a few confrontations sort of" (Brendan, lines 40-41). When asked to explain the confrontations, Brendan offered the following:

> I met her sometimes--not over exactly really bad things, but I sort of knew who she was and what she was like, so it was kind of good. . . . I thought it was going to be kind of hard because I had a couple incidents with her, so I thought it was going to be hard. But it went pretty smooth, considering my past. . . . I kind of got a little bit in trouble for some things that I've done in Grade 7 and Grade 8, and so I had to talk to her a couple times, but they weren't too serious, like a suspension or anything; they were just sort of a warning. (Brendan, lines 46--56)

Brendan talked about how the situation changed the relationship with Ms. "It was kind of more of a kind of friendly sort of atmosphere, not so serious. It was a little calmer, a little more joking, kind of a friendly way, so it wasn't too bad" (Brendan, lines 59-61).

> I was nervous sort of, but then after about an hour it was pretty good; I got used to it, so--in a way she was a different person, in a way, sort of; in a way not, because she was still pretty serious about some things. But then it was a little easier to get along too. (Brendan, lines 63-65)

He explained how he felt toward her after the experience compared to before.

> It's sort of easier to get along with the person after a while, because you have kind of have a little more easier conversations. I'd say now "She's not that bad. You've just got to get to know a person sort of." (Brendan, lines 201-204)

When talking about follow-up with the assistant principal, Brendan explained that he planned to continue to be a support to her.

> I said she could talk to me in class or something, at noon or something. She would feel she could ask us now. . . . If I was in class or something, she might ask our computer teacher, for example. And then if she couldn't find him or something or I was around, she could just talk to me. And then if I didn't know, she'd probably go ask another student because he might know a little more--we could all help. (Brendan, lines 188-195)

Brendan talked about his knowing more than the assistant principal did and the equality of their situation.

> I think my position was sort of an equal and a superior sometimes, because we were both learning at one time and then it was both equal, so you both didn't really know much. But then if I helped her find something that was a little higher up, then I was sort of a superior. . . . The strangest thing was the fact that she was way more educated than I was and probably will be. I'm not saying that I'm not going to college or anything, but it's more of a teacher thing, so they learned a lot more math and everything. But knowing a little more was sort of an advantage kind of, because she had a little trouble with some things, so it was easier to help. (Brendan, lines 148-151, 242-246)

Blair

Blair was asked to teach Ms. Hamilton, a CTS teacher in the area of Information Technologies and Foods. Blair had been in Ms. Hamilton's CTS classes and knew that she had good expertise in technology, but not in web page making. When asked about how he felt about teaching a teacher he replied, "At first I was a little worried, but not really, no. When I got in there it was a lot better because she was asking me questions and then I would tell her what to do" (Blair, lines 71-72).

Blair talked of role reversal. "Just switching jobs for a day with the teachers was kind of neat" (Blair, line 90). Upon reflection, Blair added, " They also had the experience of switching a job too, which I thought was kind of funny, because they enjoyed it a lot, learning a new thing and learning that students know more than they do, too" Blair, lines 116-118).

In terms of changing roles, Blair explained laughingly that, " We felt like a staff. That was the neat part maybe" (Blair, line 300). He described the teachers' reversed role.

> The teachers didn't know what to expect when they got in. For them it was just like us going into a class for the first time, meeting a new teacher, only we were the teachers. They didn't know what to expect at all. (Blair, lines 303-304)

Blair explained that he felt that he was treated quite special.

> I could tell they looked up to us more as they were trying to figure out how to do things. They treated you as an equal or even as somebody above them in this case. Yes, possibly a little bit above even that day, yes. (Blair, lines 310-313)

Blair, too, mentioned the on-going relationship he may have with his teacher. "I am going to be a sort of expert for her now. I said, "If you've got any questions, you can just ask me" (Blair, lines 346-347).

Allison

Allison worked with Mr. Donovan, the school principal. Mr. Donovan had a role in the project and felt that he needed to understand the class website and how to make a website. Allison didn't know Mr. Donovan other than as the role of principal-student. This is Mr. Donovan's first year as a principal in the school. When asked

about the thought of working with the principal, Allison talked about her apprehensions.

> It was kind of weird at first, mostly because I didn't know him, and I didn't really know how to respond to him. And he was kind of forgetful, so it was a little bit frustrating [laughs], but it wasn't bad; it was kind of fun. (Allison, lines 46-52)

Allison went on to explain, " I hadn't really heard great things about him, but then I met him, and he's pretty nice" (Allison, lines 169). After the session was over she explained the benefits of working with him. "I thought he was a much nicer guy than I had heard, so I actually know him better now. He talks to me now" (Allison, lines 169-170.

Allison reflected that, "When I see him he does sometimes say something. I am not afraid to talk to him now. I tell other people that I wouldn't mind having him as a teacher now. . . . It would be rather weird because he is the principal" (Allison, lines 175-180). Allison thought that the role reversal also affected the teachers. "I think it's an advantage because--I don't know--they get to know students on a different level" (Allison, lines 193-194). She noticed that "Some of the teachers seemed more comfortable when they were just one-on-one. They were more humorous, and they were easygoing" (Allison, line 223-224). At the end Allison said that she felt good being around the teachers that night. "I felt like a partner, pretty much" (Allison, line 246).

Overall Interaction

Students commented on the interactions with the teachers as a whole, and on the meal that followed the instructional part of the evening. Cody didn't teach Mrs. Blairmore, his language arts teacher, in the session, but he noticed that "she seemed

really kind of hyper and happy that day" (Cody, line 294). He went on to say, "Seeing that she was happy made me more happy with what I was doing" (Cody, line 310). When talking about the actions of the teachers during the meal, Cody observed, "Around the hamburgers, they were acting pretty silly. I didn't even know they would be like that" (Cody, line 395).

> They just came up and started talking to us. I just didn't--just like a normal person just coming up and just started talking to us normally, not even thinking we're in their class and we sometimes do stupid stuff in their class. (Cody, lines 380-383)

Blair also commented about the behavior at lunch where he found the teachers very relaxed.

> They were not teachers really --just like themselves again. It was kind of out-of-the-classroom behavior, just like us. When we're in the classroom, we're totally different than we are outside. That was like with them. (Blair, lines 365-370)

When Brendan looked around the room he found the teachers busy relaxed but happy. "I guess they liked the interaction thing because they like being around people because that's what their job is" (Brendan, lines 374-375).

Student Understandings: Teaching and Learning

Students in the study enjoyed reflecting about teaching methods and about effective teaching and learning. They spoke of (a) guiding the teacher in the learning, (b) providing models and being mentors, and (c) the effectiveness of their teaching.

Guiding the Teacher's Learning

Students described the general method they used in instructing their teacher partner. All five students explained that, although they were given a bit of an agenda, they ended up following the teachers' immediate learning needs.

> At first I showed him on my screen, but then when he started making his page more personalized, I just had to kind of point and tell him to do things, say, "What do you do now?" . . . It was just that mostly he had a very basic page. But then he wanted a whole lot of links to other pages, so I had to show him how to do that. (Allison, line 105, 107).

Blair agreed that he had to show the teacher what to do at certain times rather that following a prescribed list.

> To start with I just went in there; I just wanted to teach somebody new something different. . . . We got there, and were told; we were instructed. We had a little staff meeting before, and we were told about what we'd be doing. We got an outline and kind of went through what we might want to teach to our students. (Blair, lines 34-39)

Blair, however, soon found out that the given outline was not the most effective method to follow for his teacher.

> We kind of jumped around a bit, because she wanted to learn the harder stuff first. She knew the easier stuff, how to make a font and that, putting in pictures. She learned that really quickly, so we kind of jumped to the links really fast, and she wanted to get more pages up. (Blair, lines 40-43)

Blair found that being a guide was the best way to teach. "She'd tell me what she wanted to know, and then I'd say, 'Okay, this is how you do it.' And I'd say, 'Maybe we should learn this before that because--and then I would show her" (Blair, line 74-75).

As the teachers created their webpages some experimented with a variety of animation effects, including flames and moving titles. Blair found that teachers in the group had differing learner needs.

> When I looked around some others were getting things up and running really quickly. They would get their titles, flames off them really fast. We hadn't gone that far yet, but they were moving a lot quicker in animations. She wanted a more serious page. (Blair, lines 96-98)

Brendan was the third student participant who explained how individual needs of the teachers directed the instruction. "It started, and we introduced ourselves, and we wrote some things down on the board--a little agenda that was kind of helpful" (Brendan, lines 32-33).

> She knew a fair amount of what was on the agenda as far as I knew, and I taught her quite a bit. Then the part that she didn't know I kind of had a little trouble with but that's where we worked it out together and I was a helper to her. Because I didn't learn exactly all the stuff that she wanted to know. She was doing the math part, so it was kind of hard for both of us, but then we figured it out--it was good and what she needed. (Brendan, lines 68-72)

When Brendan looked around the room he noticed all the teachers' behavior.

> Most of the time they were talking, but otherwise they were pretty much focused on what they were doing, and they were asking the students questions on how to do things, so it was pretty good. They were asking all these questions and they would learn a lot, and they were pretty good. (Brendan, lines 347-351)

Cody also talked of the teaching process addressing his teachers' needs.

"We kind of got started on the checklist, and after that we just kind of went with the flow and did whatever he wanted" (Cody, line 68). Cody was surprised at the low level of skills his teacher partner possessed.

> He didn't know how to even put a background or anything on it. . . . He knew how to cut and paste, but when he pasted it on, he thought everything would go the way he wanted it, but he had to tab over a space over so he could get the picture in the right spot. He was getting kind of frustrated with that because he'd forget to space or tab. (Cody, lines 108-109)

Cody described how his partner wished to learn how to link pictures.

> At the start he couldn't--when we went to actually go check it on the Internet, all the pages wouldn't work, and I'm like, "What did you save it to?" He's like, "CTS homepage." I'm like, "You have to change that to index." He's like, "I have," and he was just totally confused after that. . . .
> Yes, I think he knows what he's doing now, because now he's starting a homepage for his CTS lab with pictures and links and other pages. I think I taught him what he needs to know. (Cody, lines 119-125)

Cody thought the best way to show the teacher was to point. "I never once went up and took his mouse. Teachers do that to us all the time" (Cody, lines165-166). He went on to say, "In the room, I saw a lot of pointing and teachers saying, 'What's that?' and 'How do you do that?' Yes, there was a lot of pointing" (Cody, lines 345-446).

Heather as well felt that teachers leading their own learning worked well. "We sort of looked on the sheet, and he said what he'd most like to learn, and then we did that first. And then sometimes it would lead into something else he needed to know" (Heather, lines 41-42).

Modeling and Mentoring

Four student participants spoke of the effectiveness of modeling and mentoring when they were teaching the teacher. They found it effective to show how to do something or to demonstrate their web page as a learning tool.

> I think he was a pretty fast learner. . . . He learned best just by me doing it with him on my computer, and then he'd do the same thing on his computer. . . . We did some things a couple of times, the harder things. Some things he'd forget, but we'd do it again and he'd remember. (Heather, lines 71-72, 78-79)

> At the very start I'd show him and tell him what we had to do, and then he'd do it, and then I'd show him. And if he had something, he'd tell me and then we'd go over what he wanted to learn over again; that he wasn't sure of, I'd just show him. (Cody, lines 280-283)

> We looked at my webpage briefly, and then if she asked me a question I would answer it and then give an example of how to do it on the computer. . . . If she was still having a little trouble, I'd just kind of show her how to do it on her computer. . . . I would tell her and then show examples of it because, okay, you learn how to do it, but then you see an example of it--you learn more if you've got an example. (Brendan, lines, 43-44, 81-82, 123-124)

> She wanted to do some text things. She wanted to get the pages going. She wanted sections first and then we were going to do the text. I showed her my page briefly and then showed her how to do it and she watched. Teachers are fast learners; they know what they are doing. (Blair, lines 100-103)

Effectiveness of Teaching Methods

During the interviews, all students were asked if they would participate in a similar professional development day again if they had the chance. During that discussion, reflections occurred about the event, about why the methods the students used seemed to be effective in the situation and, about what the students might do differently another time. Students compared how they instructed their teacher to how they themselves are taught in a normal school environment.

> I think teaching one-on-one is good. The teachers in the group--some would go a little slower and go from really the basic, so it was a lot better. . . . In class sometimes I sit there bored waiting for the ones that don't know to catch up and sometimes I just go right ahead, and I get in trouble for going too far [laughs]" (Blair, lines 108, 137-138).

> Sometimes I had to kind of get his attention. He wasn't listening, and he'd do something totally opposite of what I asked. . . . I just kind of shook my head and just kept on going. I didn't want to say anything or I didn't want to make him get mad at me or anything. But I was there when he realized he was lost. I would learn better with one person rather than a guy teaching a whole bunch of people. . . . It's better doing it hands-on, because, like they say, you learn more when you actually do it than when you just hear it. . . . It's no use doing something he doesn't want to know, that he won't use. (Cody, lines 152-156, 184-185)

> It was a lot easier to help only one person because you could just focus on what they were doing instead of teaching a group or something, because you have to kind of see what everybody else is doing, and then you have to help one person at a time. And then somebody else would have a different problem, and you'd have to really know your stuff because you'd have to help more people, and they'd have different problems. (Brendan, lines 121-125)

Brendan went on to further discuss the idea of one-on- on teaching. "One-on-one would be better in our school classes, but as a group it takes less time. In your school day you don't really have a lot of time to teach all the students by themselves" (Brendan, line 434).

> Maybe if we did it again, I'd have sort of a two-on-one sort of thing, two students teaching the teacher, because you'd kind of each know sort of what you're doing. And if you have trouble, the other person might know a little more than you. . . . If the other person had a little trouble or something and if you had to go to the washroom or whatever, if you had to take a break, then the other person could keep teaching. Then you could come back, and then if they needed some more help. (Brendan, lines 434-444)

> The way we taught was good for teachers because they can use it, and it's good to continue with technology, because now they can know what's going on. My teacher can use that for the project we have to do. He could find webpages that would be good or find information and help with our group web page. (Heather, lines 124-125)

Allison found her teacher needed personal attention to review, "Because he's old and has a bad memory" (Allison, line 138).

> He had saved some websites, and then he didn't know how to find them or how to attach them. That was kind of shocking for me. He had had them bookmarked, but he didn't know how to go back and find them. (Allison, lines 120-124)

Cody also thought the teaching situation was effective because the teachers then would be more empathetic to students in the future.

> They will know what it feels like to be a student without getting--and it's just like thinking, when our kids get confused and they get kind of

> mad because they didn't learn it the first time, and now they know how it feels. (Cody, lines 167-170)

Student Understandings: Rewards

The students all thought the experience was a motivational experience. Three students also mentioned that their parents' reaction was rewarding.

Motivational Experience

Student comments focused on the energy and happiness in the room during the professional development activity. "There was an atmosphere that was energetic or something. Everyone came and was pumped up or something (Allison, line 285).

> I felt more important, because I'm doing the teaching; they're doing the listening. So I felt up there. . . . I felt like I had accomplished what I came there to accomplish--it was happy, I think. Everyone was having fun with it. . . . And there was sort of a magic kind of. (Blair, lines 492, 495-497, 499)

> I did it because it sounded kind of fun, and it was. . . . I felt like a teacher because on our achievement exams we wrote, I learned my marks just a little while ago, and the teacher probably felt pretty good because we did really good on our exams. So then they kind of feel, "Yes, I did a good job. I taught them everything they need to do, so--that is how I feel now." (Brendan, lines 500, 509-512)

"Actually, it felt pretty good when he said I did a good job and I helped him out and now he knew what he was doing" (Cody, line 369).

> You feel like you did something important . . . You feel like you are important and you have to be responsible for this. It shows some leadership, because you are helping a teaching to teach--you are a leader in the school. . . . I taught a teacher how to make a webpage, and it was pretty fun. And I think he really learned a lot from it. (Heather, lines 196-197, 200)

Parent Comments

Three students thought that by participating, their parents were proud of them. "My mom said--she was like, "Oh, it's probably going to be a good experience for you to kind of teach someone else to do something . . . . Then she said she was impressed" (Cody, lines 270-271). "Mom was really interested and kind of laughed at the whole thing--she knows the teachers pretty well" (Heather, lines 458-459). "My mom said '*You* are the teacher?' Good for you!" (Brendan, line 366).

Teachers

Two major categories emerged from the analysis of the teachers' transcripts. The teachers' perceptions of learning technology from students focused on (a) effective professional development, and (b) additional understandings of the experience. Included within the professional development category are three themes that reflect current research literature and one new theme that centres on students as instructors. Themes in the *understandings* category deal with understandings of teachers about themselves and about their students. Each of these themes provides meaningful insights from each participant.

Teacher Understandings: Effective Professional Development

Three themes that emerged from the findings are also supported in the research literature. These themes are: (a) effective professional development provides a connection between curriculum and technology; (b) effective professional development includes activities that provide ongoing support; and (c) effective

professional development includes activities that move teachers to change teaching practice. A fourth theme related to effective professional development involves insights about students as effective teachers.

Connections to Curriculum

The teacher participants in this study described the professional development activity with students as beneficial because of its connections to curriculum and its immediate transfer to classroom practice. Teachers described traditional professional development activities as disconnected from practice, where learning is forgotten once they return to busy classroom schedules, or where the professional development activity may have been connected to their teaching assignment but went beyond immediate classroom needs. All five teacher participants thought the professional development with students was effective because they were able to learn just what they needed for the class they were teaching.

> It is different than going to your local PD. On PD days you are kind of, like you say, draggy; you're not looking forward to it because it's all general topics; it's not specific to your area of study. If you go to your CTS conference or your Specialist Council conference, they're more specific to what you're trying to learn, and you feel like you might get something when you come out of it. And it is even better here. When you went with the kids, you knew at the end of it, at the end of the two hours or whatever, you were going to come out with something. You will take something back to the class you are teaching. (Ms. Hamilton, lines 67-71)

> I believe I did go to a Power Point session. I'm trying to think here. And then what ends up happening is, you go to these things, you learn it all, all big bang, here it is, this is how you do it, and you can do it at that time, but then if you don't go back and use all of those things, you forget. And I did, yes, go to a PowerPoint one at the high school and never used it in the classes I was teaching. With the PD with the kids, I guess I got out of it that I actually learned some of the program, the Excel. I could see where it could be used in a classroom--right in the grade nine social studies we are doing. At the beginning I didn't think

it could even be used in social studies, and then I actually was able to see how it could be used in the unit. It's always good to be able to use it right away. PD should all be like this--teachers should always come with an assignment in something, so that when you're doing and learning, you can see the value of it, that it's just not something that you're making up. You need to have a real problem or lesson. (Ms. Winters, Lines 27-31)

And so we could have somebody come in that knows a number of things about computer websites, but may have been far above my head as to what I needed to know at that point. And so I think it's important to know what it is that we do want to know for the particular curriculum we are teaching and find the people that will help us the best achieving that. Having someone come in from afar doesn't necessarily mean that that's going to be better. . . . I think the biggest difficulty I've seen with PD activities that we've done in the past is that we are instructed in it, but then we have no reason to use it afterwards. I refer back to the technology classes that I had. People were very knowledgeable, taught us very well about what it was, but I had no reason to do any PowerPoint or presentations or to use Excel after that. The one that we did with the students in Webpage design and research and having the students do is going to be used because I'm going to have to work with it in my science classes right away. (Mr. Vernon, Lines 193-195, 430-435)

It turned out fine. We all learned a lot about the technology and talked about the classroom unit we were going to use it in. We didn't go too far. And with the students we were able to go back, and it was absolutely wonderful to go back in with a class and again have three people to rely upon in terms of, "Okay, how did this work again?" (Mrs. Blairmore, lines 63-68)

Learning technology like this for a particular lesson just changes the whole atmosphere of a classroom. Things are more relaxed because we're all working towards the same goal. Kids buy into that right now. They come in, "Okay, what are we doing? This is what we have to do." It's none of this, "Oh, do we have to do this today?" That just doesn't happen any more because we're all headed in the same direction. (Mrs. Cardston, lines 214- 217)

Ongoing Support

Teachers in the study felt increased confidence in their ability to integrate technology into practice when they were able access technological support from the

students who had worked with them in the professional development day. In some cases, teachers were simply happy to know that the student would be in the school or the class and that they would feel free to call on them at any time. Mrs. Blairmore mentioned the possibility of a technology buddy. "The student you worked with could be your buddy for the year. You could call on them and say, 'Show me that again? What did we do here? How do we do that?' and they would always be there for you" (Mrs. Blairmore, line 54). Mr. Vernon also talked of the ease of using the student as an assistant back in subsequent school days.

> I think it would be easier to use that person that you worked with rather than even a technician. In fact, you've developed in the hour and a half a different sort of relationship. I would feel more comfortable in calling on her and saying, "Could you help? Because we did this before. You knew how to do this yesterday," and I would know that she did that and would understand why I wanted to know. (Mr. Vernon, lines 43-48)

Ms. Hamilton described the experience of making a web page and how using the student as a follow-up was beneficial.

> For myself, number one, I felt successful that I had a webpage. I haven't had time to work on it since then, but I think I have the skills to go back and do that. Number two, I feel that I can go and talk to that student at any time and ask him for advice on "How do I do this?" And I think he would feel quite easy about wouldn't feel upset at all about coming and giving you some instruction. If you're going to do a newspaper within your classroom or something, you'll use it, they'll use it; it's a benefit. (Ms. Hamilton, lines 233-235)

Ms. Winters and Mrs. Blairmore described the ease of using a student's expertise in providing follow-up to professional learning.

> The one-on-one relationship with the student, I thought that was neat. And the fact that you could then go back to that student if you had a problem and that that student's always available; it's not somebody that's out in the community or out in Edmonton or somewhere that came in to teach that. That student's always in the school, and you

> could go and find him and say, "I don't know what I'm doing wrong. Can you help me here? After it's over and you have questions still, if there's nobody else from your school that can help you, you're kind of stuck. And then even if there's another teacher, then you've got to go do it after school when you're tired. But if this student's in your class, it can be at the time you need to know it. (Ms. Winters, lines 78-81)

> So that's sort of the next step, we learn together and so the follow-up doesn't have to be in isolation either. The students can support you all the way through this. You can give them the content; you can give them what your outcomes are going to be, research or whatever. And then you have confidence in actually using the program to teach when you are sure that these kids would be willing to answer questions if you had trouble. I can see if you get stuck, get them for another little tutorial: "How did you do that? How did you do this graph?" So then you'll know. (Mrs. Blairmore, line 578-580)

Change in Teaching Practice

All five teachers found that the participation in the study led to reflection about teaching and learning and to potential change in their teaching practice. They realized that the traditional top-down approach to teaching cannot work well in a classroom where the teacher is relying on students' knowledge in order to maximize learning experiences. In the teachers' experience, the use of technology often necessitated reliance on students, and all five teacher participants believed that most teachers would be willing to try a student-centred approach in circumstances involving technology use. The apparent success of those professional development lessons led to reflection about student-centred learning environments in additional classes.

All five teacher participants talked about the traditional classroom and about their present instructional practice. They mentioned the switch to student-centred classrooms and their new role as a facilitator.

Student-Centred Classrooms

Four of the five teacher participants thought that technology use might encourage them to adopt more student-centred classrooms. Mr. Vernon vividly described his teaching practice and why he has adopted the methods he has. "I guess sometimes we tend to do that top-down approach. We say, 'This is what you shall do, and it shall happen in this order'" (Mr. Vernon, lines 37-38). Mr. Vernon went on to talk about the traditional training he received in order to become a science teacher.

> I remember university--even in the science CI [curriculum and instruction]courses, it was "The teacher shall research the unit plans and know all the lesson plans and know all the content and know where they should be and know all the answers," and that's how we organized ourselves to teach science. . . . We were the imparters of knowledge; we had the knowledge, and we got them in groups. And when they ran into trouble, we could help them because we knew all the answers, and we don't any more. (Mr. Vernon, lines 160-162)

One model of teaching in a student-centred classroom is where students learn technology through exploration and then teach each other. Mrs. Blairmore spoke of a language arts animal unit where grade seven students were representing their understandings of unique animals through graphics. The environment spontaneously switched to a student-centred approach.

> On the computer, they imported a picture, and some of them put a border on it. They were to use all of the various things that are available to them in terms of technology: different sizes of font, different styles of font, indenting, centering. In other words, show off how much you know. Use of bullets, which some are more proficient at than others. And again, that's an opportunity; they look to see what everyone else is doing; then, "Oh, I want to try that. How do you do that?" It is wonderful to have a class and have students to rely upon in terms of, "Okay, how did this work again?" (Mrs. Blairmore, lines 41-48)

Mr. Vernon then talked about a more student-centred classroom where students, when given the opportunity, were very willing to share.

> I think they're far more willing to share with each other about what they do than sometimes we as teachers are. Now, maybe we don't have the time to do that all the time, but they seem to connect with each other far better, like "I did this on my page," and then someone will say, "How did you do that?" "I'll show you how I did that." (Mr. Vernon, lines 42-46)

Ms. Hamilton commented that, "If I ever had the opportunity to teach business again, I would allow more peer teaching with each other" (line 110). She went on to describe peer teaching when technology is involved.

> It's for both the kid who is teaching and learning. It's no different than being in a regular classroom. If you only have a few kids and there's not near as many questions being asked, they're not getting a variety of answers, which is a learning tool as well. So if one student's having trouble getting into Word, for instance, and another student can help them, then they're gaining some knowledge. And kids have more patience sometimes than the adults do because you're busy dealing with a behavior over here. . . . And the kids, when you get them into it and show them the basis of it, they will learn far more than we will. (Ms. Hamilton, lines 112-118)

Ms. Hamilton recognized that technology could help assist student-centred classrooms where students help each other.

> They would see what other students have done, and then they would show that pride in what they have accomplished as well. I think they'd really like that. I think it would just grow. I think that exists already in my classroom. I think that anybody, if you've got something to teach us, we're willing to hear it or listen to it. I just think that technology could grow, would help that. (Ms. Hamilton, line. 173)

Teachers as Facilitators

Three teachers described how the use of technology is forcing them into the role of a facilitator, and they talked about that changing role.

As Mr. Vernon described the experience of working in technology, he admitted that he saw his role changing. "You're still the teacher, but I think you become more of a facilitator as opposed to, 'I know all the answers. I will help you understand those answers,' it is now, 'I will help all of us try and find the answers'"(Mr. Vernon, line 125).

He explained that teachers often become facilitators because of lack of time.

> I think we need to facilitate more of them sharing what they do know with each other, and that's how we all get better. I don't think I would have the time to understand computers inside and out and be able to stay ahead of what they do. (Mr. Vernon, lines142- 144)

Mr. Vernon also talked of a paradigm change. "I think as teachers that if we are going to make this work, we have to be willing to say, 'I don't know how to do this. Does anybody know that?'" (Mr. Vernon, line 127). Mr. Vernon admitted that he didn't know all the answers.

> But next year when we get into technology stuff, there's a lot of different ideas now that I have of how we're going to do what we have to do, and some of it is going to relate to sharing among students about how they do things, because I don't know the answers . . . when we go into doing things next year, we're going to use *them* as a lot more resources. Because I know I don't have the skills that they have. Even with what I've done that one day, I still don't have their skills, and so I know a little bit more than what I knew before, and I'll work on that, but when we get into that day where we have to start doing things, it's going to be, "We need to do this. Who knows how? And let's share and figure out how we can get this done." (Mr. Vernon, lines 67- 74)

Ms. Hamilton also talked of the change in teachers' roles. "Our role is changing so much as teachers. There's so much information out there that we don't have the grip that they maybe felt they had back in the '40s and '50s" (Ms. Hamilton, line 143). She described the role as a facilitator as one "where we're learning with the kids" (Ms. Hamilton, line 144). "We're here to learn how to do this together. I don't

know either, so let's give it a whirl and see what we can do" (Ms. Hamilton, line 147). Ms. Hamilton told of teachers traditionally being the one in front of the class delivering lessons, and realized that it doesn't have to be that way. She described the new role of teachers as "The ones who get everything stirred up and get everything going, but they don't always have to be the one in front of the room" (Ms. Hamilton, line 153).

Ms. Hamilton described the experience of being a facilitator in a classroom.

> In order to get the kids to go ahead and do things, they have to feel comfortable that you're going to give them the anchor, and I end up being just the facilitator. "Okay, what do you want to do? How are we going to do it? Let's work it out. Let's figure out a plan." (Ms. Hamilton, lines 267-270)

Ms. Hamilton went on to talk about teachers and students as partners in a classroom setting.

> It helps if everybody is on the same wavelength. And if we still have somebody who wants to be authoritarian that says, "I know everything," I think it's a drawback. Everybody has got to be buying the same plan." (Ms. Hamilton, line 149)

Sometimes being in charge of a student-centred classroom involves students actually involved in the creation of lessons. In technology-related classrooms, this practice is now occurring. Ms. Hamilton described classes where students created lessons.

> Some teachers actually have kids develop CTS modules for them, because that way you get the kids' ideas on what they want, and I think that's quite effective. You may not use all of it, but you might--I know there's some people who have actually given credit to kids who have developed--maybe they're doing a word-processing unit or something like that, but I've heard of that, and I think that would be beneficial. (Ms. Hamilton, lines 160-166)

As well, Ms. Hamilton talked about teachers' self -perception changing when they use technology in the classroom. She talked about teachers having to learn along with the students.

> I think with this technology you have to be willing to *admit* that you don't know how to do these things, because if you try to fake your way through, they know. Even in your subject area, you have to admit, because they'll know; they can figure it out. (Ms. Hamilton, line 81-84)

Ms. Hamilton spoke of the change in the way course content is delivered when the teacher becomes the facilitator. "You can really add to your lessons. You're not just reading a textbook and doing a worksheet; you can actually add an extra element in there, and the kids really like the hands-on" (Ms. Hamilton, lines 132-135). Ms. Hamilton talked of doing research and using the Internet as alternative teaching methods. She also commented that the method students used to present information has changed. "Before it was just a poster, drawing a poster, color it. Now there's so many different ways that they can present their information using technology. Students have more control over their learning" (Ms. Hamilton, lines 150-151).

Teacher Understandings: The Teacher's Experience

Teachers in the study shared what the experience was like for themselves as well as what they felt it was like for their students. Teachers in the study felt that being involved in productive and effective professional development was a reward in itself; however, there were there were other benefits and rewards associated with learning from their students. These additional teacher-related rewards included: (a)

enhanced student-teacher relationships during and after the professional development day; (b) the opportunity to observe and participate as their students assumed a teaching role); (c) the opportunity to learn a technology activity one-on-one; d) seeing students happy and successful; and (e) the opportunity to realize that students are effective in instructing technology to their teachers.

Student-Teacher Relationships

Four of the five teachers mentioned that the experience of participating in the professional development day with students enhanced the relationship they had with that student. They felt that this new relationship was of benefit to them as a teacher. In the beginning, some teachers feared that either the student or the teacher would be intimidated. Mr. Vernon expressed his initial concern.

> I was concerned--not really concerned. I wondered how they would respond to me as their teacher not knowing what it was that I was doing, because it was a complete role reversal from what we do in our classroom that day till after school, and suddenly, guess what? You're teaching me; and the idea that I'm the teacher and I should know this, but I don't. As it turned out, that was unfounded; it didn't really matter. To them they were quite comfortable with it. But I didn't quite know how that would come together. (Mr. Vernon, lines 9-14)

Ms. Hamilton echoed Mr. Vernon's initial concern.

> Oh, I was a little nervous at the beginning, because I thought, I don't really know anything about this, and when you don't know anything and then you're going to tell the kids that you don't know anything, that's a little [laughs], a little nerve wracking just to actually admit that they actually know more than you do. (Ms. Hamilton, lines 41-45)

However, the four teachers went on to talk about how the professional development experience enabled the students and teachers to build a unique and beneficial relationship.

> Working with the students was I would say, very close to being equal. They didn't feel intimidated that I was the adult and their teacher, and they had to tell me. And I didn't feel intimidated that they knew a whole bunch more than what I did. It was really just one-on-one and "Let's do this." (Mr. Vernon, lines 6-10)

Mr. Vernon went on to explain why he thought the new relationship was successful.

> You interact with students in a different way, similar to coaching a team after school. So regardless of what the content is, I think you learn from them, they learn from you, and you understand them more as a person as opposed to a teacher-student relationship. I think that's a good thing. (Mr. Vernon, lines 22-25)

Ms. Hamilton explained how the development of the relationship with the student was a reward in itself.

> When you did the PD with the kids, you knew at the end of it, at the end of the two hours or whatever, you were going to come out with something. Maybe it's a relationship with a new kid; maybe that's all **you** learned. But you came out with something, because you knew you were coming out with something. So if you just came out with a new relationship, it's going to be there tomorrow in this school in your job. And that might be enough. That might be all there is. (Ms. Hamilton, lines 250-252)

Ms. Hamilton described the changed relationship between herself and the grade nine student who taught her during the professional development experience.

> We've always had a pretty good relationship, the two of us, yes. But I think now maybe he can understand where I'm coming from a little more, and I can understand him, and he would become the teacher. Some of us were kind of fooling around there, pretending we were the students: "Well, I don't get this. I don't—" that kind of thing; and he could actually see what it's like to be the teacher. It was neat to be a student too. (Ms. Hamilton, lines 46-50)

She talked about being able to relax after the session began and the relationship with the student warmed.

> I was nervous about saying the wrong thing or doing the wrong thing. And at the beginning I was nervous, so I couldn't get the mouse to even work to highlight things, and after a few minutes I relaxed. . . . I cared about what he thought, because he looks to me for information, and now I look like I don't know what I'm talking about, but the pretty soon I saw him as a helper. (Ms. Hamilton, lines 52-57)

Mrs. Blairmore commented that "Any time you spend more time one-on-one with a student, it strengthens the relationship--especially when there are thirty in the class, because you don't have that time to be able to get to know them that well" (Mrs. Blairmore, lines 357-359). Mrs. Blairmore pointed out that the students who are technology leaders in schools are often not the ones who excel in the student union or in sports, so the experience may have been very beneficial to them.

> A number of them are different, and you don't get to know them in extra-curricular activities, so this activity is positive. . . . In fact, I think he [the student] is going to help me with some things even if he is in high school. He may work with me on the [school newspaper]. (Mrs. Blairmore, lines 379-380)

Happy and Successful Students

The opportunity to see students performing well, enjoying themselves and being enthusiastic about learning was in itself rewarding to teachers. All five teachers in this study commented that one of the key rewards in the study was the opportunity to see students engaged and happy and being successful at teaching technology.

These comments illustrate how the teachers felt rewarded by seeing their students happy.

> I loved to see the students in there - I don't know. I think because they were so eager. They were just dying to give that information, so they just felt like they were I think the rest of us just get tired maybe and whatever, but they were ready, they were just so eager to give the information that these people needed. It was neat for us. (Mrs. Cardston, lines 68-12)

> I didn't know of course you know that students understand computers better than we do, but I didn't know that she had the skills to do this,

> and the sites that she had found and the places that she had gone searching to find things for what we wanted. She'd pull up something on her webpage; I'd say, "How do you do that?" "Oh, you just go to this site." I would have had no idea that she knew that information. It was rewarding to let them know that we didn't know their talents. (Mr. Vernon, lines 23-26)

> Oh it is energy – positive energy. They walk in the door grinning and they sit down. They are not ready to work right away, maybe, but it is a positive thing. There is not this whining, "Do we have to do this?" (Mrs. Blairmore, lines 295-296)

Observing Student Instructors

All five teachers in the study were enthusiastic about describing how the students actually taught them what they needed to know. They were interested in, and impressed by the students' abilities. Mr. Vernon talked about how the student approached and modeled the activity.

> Her webpage was up and running so we could see what it was that maybe we wanted to do. A checklist was provided so that we could go through the checklist and say, "Yes, I'd like to see this and this and this." And then throughout the evening she would have us interact with each other, go around the room and say, "Look what this person has done, look what this person has done." (Mr. Vernon, lines 92-96)

Mr. Vernon also talked of how the students approached the session differently than adults traditionally do.

> Adults tend to teach more: "You should do this, do this, do this," whereas the students, at least the one I had, said, "What do you want to do?" And "Okay, let's do it." And they weren't afraid. I think the biggest thing is, they weren't afraid. If something went wrong and they didn't know what to do, they didn't feel because they were in some sort of instructional sort of role that they had to know all the answers, and it didn't bother them if they didn't know the answers." (Mr. Vernon, lines 99-106)

Ms. Hamilton also talked about the student approach to teaching. "He just pointed. 'You need to go back here. How did we get back there?' And he was good

that way" (Ms. Hamilton, line 37). Ms. Hamilton enjoyed talking about structure of the professional development experience.

> I did whatever he told me to do; and no, we didn't follow any set . . . basically, one led into the other to the other to the other because, like you said, I've had a little bit of computer background, so I asked a few questions which led into another step, and we kind of skipped a few here or there. . . . It was good to be on the other side of the fence and have them teach you, because you learn things that we do, we grab the mouse: "Let me show you how it's done." We show, but it's not the same as, "No, you go here and do this. You point to it. You do it." And that's how they learn. They seemed like they were just sort of natural teachers. (Ms. Hamilton, lines 38-42, 153-154)

Ms. Hamilton described her experience about how the student approached teaching her.

> I was matched up with a Grade 9 student, a boy, and it went really well. He's student that I'm always after to get his work done and be more motivated, try different things, don't be lazy; and so it was kind of comical at the beginning. He wanted to get after me. He was very good. He wanted me to do things, not just tell me how to do it. He showed me, and then I had to actually do it. I learned a lot from him. I was actually able to produce something at the end, which was nice, and I also could see ways that I could use that program, which was good, because lots of times there's no use for it. (Ms. Hamilton, lines 25-31)

Mrs. Cardston discussed how the teachers were relaxed having the students as teachers.

> Teachers could see that that's okay to accept that maybe they didn't know and the students were quite willing to give the information, not flaunt it, not make them feel bad about it, but just give them the information and see them use that information to do what they wanted to do, get them the answers that they wanted. The teachers all got to the same place, but they all did it a different order and they all did it a different way. (Mrs. Cardston, lines 59-65)

One-on One Teaching

All five teachers explained how the professional development experience was rewarding because they were given a chance to be one-on-one with the person who

was teaching them. The opportunity to learn at their own pace benefited their learning.

Mrs. Cardston talked about the need for one-on-one instruction. "The teachers went through the stuff they knew very quickly, and when they came to a bottleneck, they had someone there to immediately bail them out and show them how" (Mrs. Cardston, line 4).

> The teachers said how excited they were because they got one-on-one answers. So instead of sitting in a classroom or a session that has twenty or twenty-five people or thirty people in it, they had an individual sitting right beside them, and when they said, "Oh, where was I supposed to be again?" the student was right there to say, "Oh, here. This is what you do, this is how you do it," point it out, and so they got immediate feedback, and they were able to just keep motoring on. So I think they really felt that it was time well spent, that they really got something they could use out of it. . . . And what slowed one down didn't slow another down. So if you were working in a big group like that, you would find everybody's waiting for this step, and then they're waiting for that. Well, you're going to lose their attention, and maybe they already knew that, but they wanted to know three different other things. So, yes, they'd move at the individual pace, the idea that you can move at your own pace and learn when you want is important. (Mrs. Cardston, lines 5-11, 28-32)

Mr. Vernon agreed with what Mrs. Cardston observed.

> I think part of that is the one-on-one, and I remember having to refer back to the other PD activity, one person at the front doing this. And what happens, I think, someone gets lost. They don't follow the steps, and then suddenly they're off track, and they don't know how to get this, and they start talking to somebody else about something, and then it doesn't work any more; whereas this, you have one-on-one, and we progressed at whatever speed we wanted to. (Mr. Vernon, lines 36-41).

Mrs. Blairmore and Ms. Hamilton also felt that they benefited from one-on-one instruction.

> The one-on-one means you go at your own pace, and you stop and you deal with whatever needs to be dealt with. But probably teachers behave better with students in the room too [laughs], just like students

> behave better with teachers. It's a win-win situation. (Mrs. Blairmore, lines 83-87)

> When the teachers began working on their pages, I saw just a couple of kids kind of daydreaming around. But most of them got their own out and kind of did a few fine tunings on it and that kind of stuff, and they were there to answer your questions, and it was good that way. . . . I really think that there would be an awful lot of use at a PD day if there was one or two students for one or two staff where they could actually sit down and do that kind of stuff, because a lot of times you go to PD sessions and we have one person at the front, and he can't get to you. It's just like being in a class. (Ms. Hamilton, lines 37-39, 95-100)

Ms. Hamilton talked about the success of the one-on-one approach.

> I think because you had a question right then, needed it answered right then, it was really good. And if you had to wait for the instructor to come around to you and also sometimes you feel stupid, so you don't want to ask. Somebody else is already four steps ahead of you, and you're kind of going, "Okay, how did they get there?" And so you're behind, and if someone's sitting right there beside you, they can say, "You just do this and this and this." "Oh, okay." (Ms. Hamilton, lines 197-202)

Student Instructor Effectiveness

Four teachers mentioned that they were impressed at the quality of student knowledge and considered them effective instructors. "I would consider the student I worked with to be very close to an expert, at least where I was coming from and not knowing anything" (Mr. Vernon, lines 140-142).

> And I guess the other positive thing is, we want to learn what it is we have to do, and they're the ones that know it because they're farther ahead of us in the computer technology work because they do it all the time, and we don't. . . . Especially in the area of computers, because they go so quickly, and we can't keep up to it. It was at one time that teachers had to learn everything or understand everything, and then we imparted that knowledge to them. But they are so far ahead of us in the knowledge because of what they do, we don't keep up. (Mr. Vernon, lines 23-27, 205-212)

Mrs. Blairmore commented that "I know in my mind any time we run into difficulties, I've always got one student who can figure things out" (Mrs. Blairmore, line 19). She continued with the following:

> You learn with kids, ever since day one, because you've got kids out there who know more than we do and do not hesitate to share it, but do it in a very positive way, I think, ever since we've started with technology. . . . And I would say to him, "Okay, what do we do next?" "Okay, if you're making notes, put this down." [laughs] It was great; it was great. And then we came up his experiences he would share with me when we were putting the pages together and colors and whatnot, and he'd say, "Well," he said, "you might want to try this or not try this because I've done it and it didn't work. You can see what it looks like, but this is what happened when I did it." So again, a very open, sharing part that went on there. (Mrs. Blairmore, lines 21-23, 70-76)

Ms. Hamilton and Ms. Winters were also confident in the knowledge that the students possessed.

> The kids are way ahead of me any more when you [public address system interruption; recording interrupted] One reason I signed up was because the kids were way ahead of me. And number two, I think just the idea that the Internet is moving at such a fast pace and is part of our everyday life, we need to keep up with it and know what's going on and the kids are the best teachers for that. . . . It was quite fun actually. Kids were excellent, because they were the cream of the crop, so to speak. They were the ones that knew what they were doing. Very knowledgeable. (Ms. Hamilton, lines 33-40)

> It was nice to see that he knew, that he was able to teach somebody something. That was really neat, that he knew enough and that he was pretty proud of that, that he knew this information and these teachers in the room didn't. (Ms. Winters, lines 191-192)

Teacher Understandings: The Student's Experience

Teachers felt that the experience was beneficial to students as well as to themselves. One of the benefits to students was that they were given the opportunity to actually teach. Interestingly, all teacher participants discussed the actual *teaching*

as a benefit to both teachers and students. I have discussed their comments about the teaching process in the *Benefits to Teachers* section. Teachers believed that students also benefited because they (a) were engaged and motivated, (b) experienced an enhanced relationship with their teacher, (c) felt increased confidence in themselves.

Engaged and Motivated

All five teachers in the study said that the most obvious benefit to the student was that the experience was highly motivational to the student instructor.

> What I saw right away was kids and teachers that were really enthused about what they were doing. Right away I saw beaming faces, and I saw eagerness and bright eyes. I just noticed from the conversation and the looks that were being exchanged between the individuals that it was working right away, and then comments afterwards. The kids won't tell you that, but you can see that they were pleased with themselves. They were playing a teacher role, and they were being very effective, and they knew something that these other people didn't, and they were conveying it. They were excited about it. (Mrs. Cardston, lines 7-14)

> They were very eager; and you could just tell by the looks on their faces, they were just so pleased with themselves. . . . It is something magic, yes, because you could really see that everybody was pleased with themselves there. The ownership is there, and as a result, there's far more caring about what goes into it. Oh, very busy, and everyone was having a great time, but busy, busy, busy. (Mrs. Blairmore, lines 34-40)

Ms. Hamilton explained how student motivation added reward to the session. "Yes, it was a little different. But I think for him he probably felt like he'd just won a major sporting event or whatever, skateboard tournament or whatever" (Ms. Hamilton, lines 103-105). She added, " I said to him a couple of times, 'You're awesome' or 'You've done a really good job. Thank you

very much.' And you could just see the smile coming on the face" (Ms. Hamilton, lines 89-90)

Mr. Vernon, when talking about rewards to students also explained, "it seemed to me that they were quite happy. This was something different for them they'd never done before" (Mr. Vernon, lines 58-59).

Enhanced Relationships

Teachers felt that experiencing an enhanced relationship with the student with whom they were working was rewarding for themselves as teachers, but they also felt that the new student-teacher relationship rewarded students as well.

Four teachers indicated how they thought that students benefited by forming new relationships. Mrs. Blairmore mentioned student-teacher relationships three times during our conversation. "I had one student who said after, she said, 'They talked to me like I was a real person.' Yes. It was very much an equal" (Mrs. Blairmore, lines 100-101). When discussing the idea of student-teacher partnerships, Mrs. Blairmore went on to say, "The ownership is there, and as a result, there's far more caring about what goes into it" (Mrs. Blairmore, lines 84-85). Mrs. Blairmore went on to further describe the enhanced relationship with the student with whom she worked.

> Again, this is even later in the year, and you get a real attachment with , particularly by this point in the year. Number one, they loved to show me what they'd done; but not only that, to teach me how to do it. One of the comments that I made to the student I was working with was, I said, "Okay, now, you've got to slow it down and break it into parts." I wanted step-by-step, and he did that. (Mrs. Blairmore, lines 69-71)

Mrs. Cardston summed up the relationship with her student. "The rapport, the comfort was there very, very quickly. Within five or ten minutes you could just see" (Mrs. Cardston, lines 34-43).

Ms. Hamilton talked about the rewards to her student partner as well as the group as a whole.

> Both staff and students felt quite comfortable when they came out of there. The kids were quite honored to be chosen to be part of that group. I know several of the kids that were in there, and they were quite tickled that they were asked to be in there. . . . I think he was surprised at how fast some people can catch on to things, and I think just our relationship in the hallway is a little bit different than it was before. And I think they liked supper. [laughs] . . . They realize, I think, that we don't know everything, they don't know everything, but maybe together, if we work as a team, it's just going to be a lifelong skill that they're going to need in order to work on the jobsite too. (Ms. Hamilton, lines 166-168, 33-34, 150-151)

Mr. Vernon also expressed that students benefited from a new student-teacher relationship.

> Yes, besides the food. That's always a motivator. I think they get to see us on a different level too and that we're not always standing up in front of the classroom instructing and knowing everything. It becomes human: We don't know everything. And those of us who signed up were quite clear with that, that we don't know what we're doing in this, and you're the teacher. So I think that's a positive, that they see us in a different light. . . . I think I see it as two different levels. Number one, you interact with students in a different way, similar to coaching a team after school. So regardless of what the content is, I think you learn from them, they learn from you, and you understand them more as a person as opposed to a teacher-student relationship. (Mr. Vernon, lines 22-24, 27-29)

Increased Self Confidence

Four of the teachers thought that providing an opportunity for students to be leaders in this professional development activity contributed to increased student self-

confidence. " This kind of recognition is important to them" (Ms. Hamilton, line 166).

Ms. Hamilton described one student who lacked self-confidence and was considered by his teachers to be an attention seeker. " I think he really quite enjoyed that. He likes that attention, extra, yes" (Ms. Hamilton, lines 92-93). " He really seeks attention, and I think this is a good way that he could get some attention in the classroom" (Ms. Hamilton, line104).

> Yes, yes, I guess. It was nice to see that he knew, that he was able to teach somebody something. That was really neat, that he knew enough and that he was pretty proud of that, that he knew this information and these teachers in the room didn't. . . . I think he learned to go back, but it's a lot of steps to get to where he is he had to go back, and that took him a little while to figure out some of the basic, basic stuff I didn't know how to do. So he learned some patience, I think, and maybe a little understanding for someone that isn't as bright as he is in that subject. It gave him confidence that he hadn't had before. (Ms. Hamilton, lines 191-192, 195-200)

Ms. Hamilton concluded by saying, " It made me feel good, and he got a lot of pride out of that, I think" (Ms. Hamilton, line 193).

Mr. Vernon also said "I think it's also good for their self-esteem and confidence. They can teach somebody else something" (Mr. Vernon, lines 35-36).

> Maybe they felt, to begin with, a little bit intimidated because they were teaching teachers, and the principal was one of them, but that didn't seem to last very long. But after that, they had a job to do and a role to play, and they did that. They seemed to start to believe in themselves. (Mr. Vernon, lines 76-77)

Mrs. Blairmore talked about confidence in terms of leadership. "They became leaders. But they had that little added self-respect because they were the experts within that area and were respected for that and were more than willing to give their help" (Mrs. Blairmore, lines 45-49).

> I have one student who isn't strong in anything else he does, but if we run into a problem with computers, he would figure out how to fix it, what we needed to do, much more quickly than others. This session just added to the student's self-image. (Mrs. Blairmore, lines 126-127)

Chapter Summary

The findings in this chapter present both student understandings and teacher perspectives of a professional development event that involved teachers learning technology with students.

Student participants found that they were rewarded by (a) interacting with their teachers, (b) being able to be involved in both teaching and learning through guiding, modeling, and reflecting and (c) being motivated and receiving positive feedback from teachers and parents.

Teachers found that the professional development activity offered them effective professional development because it (a) connected to the curriculum, (b) provided ongoing support, and (c) enabled them to reflect about change in teaching practices.

Teacher understanding of learning technology from their students focused on: (a) enhanced student-teacher relationships; (b) interacting with happy and successful students; (c) the experience of observing their students in an instructor role; (d) experiencing one-on -one learning; and (e) being involved in an effective professional development activity.

Teacher participants found that rewards to their students were that (a) students were engaged and motivated, (b) students benefited from enhanced relationships with their teachers, and (c) students experienced increased self-confidence.

CHAPTER FIVE

SUMMARY, DISCUSSION AND IMPLICATIONS

Introduction

In this study I set out to find how teachers and students experienced learning and teaching together in a technology-related professional development activity and, within that context, I found myself listening to stories involving successes, understandings, relationships, and frustrations that occur when teachers attempt to use technology in their classrooms.

I had anticipated that the main thrust of my study would possibly lead to sub-questions dealing largely with the benefits and rewards of the activity. Rather than articulating benefits and rewards of the experience, however, the participants for the most part shared with me more general and personal understandings of the professional development activity. The findings reported in Chapter Four provided me with valuable insights as to how the participants experienced the event. I organized these findings by connecting them with the research literature in Chapter Two, and my review of the literature was extended beyond the original because of some emergent and unexpected findings. There is little or no research at this time that is connected to some insights that emerged from the study, especially insights I gained through student interviews. The following discussion of the findings centres on: (a) student understandings, (b) effective professional development in technology,

(c) teacher adoption of technology, (d) reflections on Moersch's model of technology integration and (e) implications for practice.

Student Understandings

Students in the study talked about the professional development day being rewarding in that it was a very motivational experience and that they enjoyed praise form their teachers and from their parents. They also felt that the atmosphere was energetic, and that they were able to see teachers in a new light. I believe, however, that the most insightful understandings articulated by the students related to teaching and learning. The students naturally adopted a "guide at the side" approach and assisted their teachers on a *need to know* basis.

Greening (1998) describes constructivist teaching as a method that concentrates on the learner's interaction with his or her environment and so considers the foci of learning to be more about developing general connections and understanding than remembering specific facts or information. Constructivist learners are situated within their own unique learning context that provides opportunities for association and the building of knowledge. As Greening puts it, "constructivists hold that knowledge and learning are dependent on context" (p. 24).

In reflecting on the method adopted by the students, one sees connections between their approach and constructivist philosophy. Students enabled their teachers to develop general connections and understandings. They guided their teachers in understanding how the webpage or an *Excel* spreadsheet could be used as a tool to extend student learning within the teachers' current classroom projects. Each student

realized that his or her teacher was learning within his or her unique context, but also encouraged the teacher to observe and collaborate with the larger group.

I find it interesting that students did not naturally teach the way they were taught; instead, they instructed their teacher in the manner in which they would like to be taught. The students described how they learned better in hands-on environments, how students learn at differing rates, and how sometimes students are bored in class. They also talked of the possibilities of peer teaching within core classes.

Student responses about what the teachers knew or did not know varied. Some were surprised at how little the teacher knew about working with the computer in such areas as file management, and others acknowledged that the teacher they worked with possessed a fairly high skill set. In either case, however, students were able to respond to individual teacher needs with a high degree of success.

Perhaps because these students are situated as learners within the school system and experience a variety of teaching methods daily, they may possess valuable insights for us--insights not only about how to learn, but also about how to teach

Effective Professional Development in Technology

Effective professional development in technology must be connected to the curriculum, must change teaching practice, and must offer teacher support (Moersch, 1995; Guhlin, 1996; Jonassen, Peck & Wilson, 1999). Professional development in technology is effective when it facilitates teachers in moving their instructional focus toward a constructivist framework (Johnson & Cooley, 2001; Moersch; 1995, Brooks & Brooks, 1993), and when it has less to do with the teaching of technology itself and

more to do with transforming teaching practices (Jacobsen, 2001). Jacobsen also states that this type of effective, transformational professional development in technology "will not occur as a result of three-hour workshops that are often decontextualized from the teacher's local context" (p. 6).

Teachers who were part of this study were not asked specifically to describe effective professional development; however, they were asked to describe the experience of students assisting them in a professional development activity that was directly related to using technology in their classrooms. As the descriptions of the activity emerged, teachers spontaneously and insightfully described a professional development event that was indeed effective in that it (a) offered ongoing and individual support, (b) was connected to the curriculum, and (c) was an experience that led to the examination and perhaps transformation of their present practices.

Ongoing and Individual Support

Current research indicates that our understanding of professional development for teachers who wish to increase their capacity for technology use has changed over time. According to research literature, the first approaches to train teachers to use technology focused on using software and hardware and these efforts were largely ineffective. Subsequent research found that professional development consisting of on-site mentoring and in-school support that responds to individual teacher needs is more effective and accelerates teachers' adoption of technology (Brown & Henscheid, 1997; Dwyer, Ringstaff & Sandholtz, 1991; Gibson & Oberg, 1999).

The opinions of teachers in the study reflect the research literature. These teachers stated that they had more confidence in using technology when they knew they had ongoing and individual support from others closely involved in their classroom endeavours. They reported that they often hesitated to use new technologies in their classes if they had no one to call on if they got into difficulty. They also stated that ready access to external technical support from district computer technicians was often not available. To the teacher participants, however, the idea of formally using students as technical supporters, co-learners, or mentors was perceived as innovative, practical, and exciting. Teachers in the study felt they would be very comfortable calling on students for help--even more so than in calling on an in-school aide or technician; teachers felt the student would understand the context of the lesson and why the teacher wished to learn the task at hand. Teachers in the study did not feel as if they were imposing on students because their students indicated that they were proud to be asked to give instructions to their teachers. Also, it was important to these teachers that they be given support within a trusting classroom environment, and they thought their students would be able to provide that support.

Moersch (1994) found that often the reason that technology-based professional development did not advance the teacher's use of technology was that the teacher's professional development experience did not connect with the teacher's level of technology implementation. According to Moersch, teachers move from a level of non-use to a level of refinement on a six-point scale, and professional development experiences can increase in effectiveness if the teacher is learning at his or her individual level. Teachers in this study agreed with Moersch in that they

reported that their learning was meaningful when they progressed individually and at their own pace and own level. Teacher participants in this study found that the students guided them at their individual instructional levels and that one-on-one instruction assisted them in going forward in the acquisition of new skills. In this way, the individual instructional level of the teacher was met.

Student understanding of the support role they are able to provide for their teachers in the use of technology is not reflected in research literature. Students thought that working with the teacher resulted in positive results for both themselves and their teachers. They understood that teachers would appreciate them as mentors because of the comfort level teachers often feel with their students. One student articulated that she understood that teachers would not be embarrassed to ask students questions because "They trust you" (Haley, line 44).

Connections to Curriculum

Researchers (see, for example, Abdal Haqq, 1998; McKenzie, 1999;) have found that to be successful in integrating technology into their classroom activities, teachers need professional development in technology based on what they are doing inside their classrooms. Participant understandings echoed the previous research findings and during the interviews teachers spoke of the professional development activity with their students as being very useful because of its immediate connection to the classroom lesson and unit plans. Teachers and students at the first research site were involved in a Telus 2learn project. They were at a point where they wished to create a website in order to share work and to further explore connections. In this

way, there was a sense of immediacy, and teachers felt a "need to know." Teacher participants stated that by relating to a clear classroom focus they did not have to imagine how they would apply the technology skills they were learning as they did in previous professional development experiences because, in this case, the technology would be used as a tool to facilitate current project learning.

Although much of current research on teacher professional development (see, for example, Guhlin, 1996; Valdez et al., 1999) focuses on curricular connections to professional development, it does not necessarily address *people* connections. It was interesting that after reflecting on classroom connections, teachers realized that at this professional development event, the presence of student instructors themselves provided a dynamic and important connection to their actual classrooms. Teacher participants at the professional development event understood the curriculum connection to the technology they were learning, but by using student instructors there was even a stronger, richer connection to the real classroom experience. The student instructors understood the classroom dynamics, the application of the technology being learned within context, and what their own learning role would be when the technology was used in the classroom. As Mrs. Blairmore declared, "We're all working towards the same goal"(line 210).

Change in Teaching Practice

Researchers such as Brooks and Brooks (1993), Jonassen, Peck and Wilson, (1999), and Moersch, (1996) have examined the role of technology in education and in related discussions have described indicators of constructivist teaching. They

describe a constructivist classroom as a place where (a) teachers allow students to drive the lesson, (b) instruction includes modeling, coaching, and exploring, and (c) technology is a tool used to find solutions, communicate results, retrieve information and facilitate inquiry-based learning. As teachers move to higher levels of technology implementation and begin to integrate technology into their classrooms, a series of changing instructional practices occurs (Moersch, 1996). As well, Resnick and Klopfer (1989) and Schunk and Zimmerman (1994) describe advances in student learning when students see each other as resources rather than as competitors.

Teacher participants did not use the terms "constructivist learning" or "constructivist classrooms" when talking of changing their teaching practice, but they did articulate their understandings of some principles of constructivist pedagogy. Teacher participants spoke of the use of technology moving them into a more student-centred approach and these participants understood that students benefited from being encouraged to create and manage webpages and to use *Excel* spreadsheets as they engaged in information processing and problem solving. The teachers also reported that they understood the non-linear organization of a student-centred classroom. They realized that when students were involved in using technology in a constructivist environment the traditional time-framed and sequential lesson plans were seldom effective.

When discussing modeling or mentoring, teacher participants' initial understandings focused on students as peer teachers and mentors in learning technology applications. Mr. Vernon described how students interacted with each other by telling of students excitedly asking each other questions such as, "How did

you do that?" (Mr. Vernon, line 45), and Ms. Winters, when talking of student interaction stated, "They really want to show off what they know" (Ms. Winters, line 146). During these discussions of student-centred classrooms; however, most teacher participants did not strongly articulate the idea of mentorship and peer teaching being beneficial within core subject areas, nor did they discuss the effectiveness of collaborative, authentic, hands-on inquiry connected to the use of technology. They talked freely of students helping each other learn how to use technology for representing, but not for problem solving or for student-directed inquiry. Although they were beginning to articulate the benefits of collaborative problem solving using technology, they were, when talking of peer teaching, coaching or mentorship, still primarily describing benefits using the framework of a content-driven curriculum rather than a student-centred, constructivist approach. For example, teachers who talked of collaboratively assembling a list of webpages for grade nine science nine easily understood that the *Statistics Canada* website would enable students to find facts. They spoke much less of providing the page to students so that they would use the facts to solve problems.

Mr. Vernon was one participant who talked about using technology to facilitate inquiry-based learning. He talked of learning traditional teaching methods in his university curriculum and instruction courses where he had been taught to "know all the content of a lesson--and to know all the answers" (line 61). Upon reflection, however, Mr. Vernon began to see successes for both himself and his students in sharing power and control when students learned technology, and he admitted that he saw his role changing even in his classes where technology is not a focus. He saw his

role changing from "I know all the answers" to "I will help all of us try and find the answers" (lines 143-144). Ms. Hamilton, as well, saw her role in the future as one where she will be "learning with the kids" (line 143).

Teacher Adoption of Technology

Moersch (1995), on his LoTi scale of technology integration, calls level or stage 1 the awareness stage. At this stage, computer based applications have little or no relevance to the individual teacher's instructional program and at this stage the use of computers is one step removed from the teacher's instructional program. In stages 2, 3, 4a and 4b, teachers, according to Moersch, move through (2) the exploration stage, where technology is used as an extension to activities, (3) the infusion (minimal) stage where technology-based tools augment instructional practice, (4a) the mechanical integration stage where technology is seen as a tool but with heavy reliance on pre-packaged materials, to (4b) the routine integration stage where technology-based tools are integrated to provide rich context for students' understandings of concepts, themes and processes.

Comments from teacher participants in the study reflected Moersch's research in that the teachers spoke of how they used technology in their classrooms. Although the participants did not articulate these experiences in terms of "technology implementation" *per se*, they did talk about expanding their capacity to use technology within their teaching assignments. The teacher participants described previous professional development activities where they learned to use an application in isolation. These experiences often resulted in frustration, as Ms. Winters stated, "I did go to a PowerPoint class at the high school and never used it back in the class I

was teaching" (line 29). Ms. Winters' experience of attending application based technology-related professional development activities with no connection to her classroom experience reflects what Moersch would have called the level one awareness stage.

Teachers in the study described the professional development experience with their students, however, as one that enabled them to begin moving to a place where they could truly integrate technology for the purpose of extending student knowledge within their curricular units. When teachers described how they moved from learning isolated applications to using technology as an enabling tool such as creating a webpage integral to their project, they were describing their own evolution from the awareness stage to a higher level where they were able to purposely infuse technology into their units.

Implications

Implications for Changing Practice

Today's teachers are in a very unusual position in that learning to infuse technology into their practice is a new and formidable task and, unique to this day and age, many teachers are missing essential skills that many of their students have already acquired. All teacher participants in this study demonstrated understanding, perhaps because of necessity, of the benefit of student-centered classes where students teach themselves and each other how to use technology applications. For many teachers, however, this professional development experience was the first they had personally attended that had not included traditional top-down instruction, but

instead involved an engaged, hands-on learning environment. All five teacher participants spoke of the uniqueness of being able to be in charge of their own learning, and how the success of this learning was made possible through the guidance of their student instructor.

During the interviews, teacher participants spoke about the high quality of their learning experience when they were in charge of their own learning and when their students assumed the role of facilitator. They began to reflect on the richness of the PD event and indicated that they saw potential educational benefit if they as teachers assumed a facilitative rather than an authoritative role in the learning of their students, even in classes not involving technology.

One implication for practice may be that teachers learning how to use technology from their students may gain pedagogical insight. These teachers were, perhaps for the first time in their careers, involved in a constructivist, learner-centred environment. However, in this case, they were the learners and their student instructors had become their facilitators and mentors. The teachers' initial motivation may have been to learn how to use an application or to make web page, but they were involved in much more than that. They became involved in working together with their students to become more knowledgeable about the Internet and to solve authentic classroom problems by using technology. As teachers in the study realized the effectiveness of this model, they may have seen that their present teaching methods would become more effective when their students are given the opportunity to learn in a constructivist, learner-centred settings. The experience of learning from student facilitators may become a catalyst for change as teachers realize the

pedagogical effectiveness of themselves being the facilitator rather than the distributor of knowledge.

Implications for Technology Integration

The first wave of professional development for technology integration, while introducing teachers to skills in using applications, failed to bring about widespread change in teaching practice (Jacobsen, 2001). The disappointing rate of change in teaching and learning with technology can in part be attributed to the lack of support of teachers' technology integration efforts (Jacobsen, 2001; Clifford & Friesen, 2001). In Alberta, there are presently some excellent initiatives in place designed to support teachers while they implement a mandatory ICT Program of Studies. The Alberta Online Consortium, the Telus Learning Connection (Telus 2learn) and the Galileo Educational Network provide leadership in effective strategies of ICT implementation and in professional development. Participation in any of these initiatives, however, is time consuming and/or costly for teachers and for professional development organizers, and some provide only limited classroom connection or support. The findings of my study may suggest that we need to continue to explore innovative approaches to extend professional development opportunities for teachers. Using students to guide teacher learning in technology professional development may be beneficial in that it gives teachers ongoing support, fosters a co-operative learning atmosphere, and provides a hands-on learning experience for themselves as teachers. As well, this type of professional development is time and cost efficient, and if students assisting teachers becomes part of a school culture, the benefits of students

assisting teachers is sustainable over time. Perhaps student involvement in the integration of ICTs will add to current professional development models in assisting teachers to be able to confidently and routinely integrate technology into their classes and to move into the final stages of technology integration, which are expansion and refinement.

Implications for Collaboration

Those in leadership positions concerned with developing leadership qualities in teachers will succeed by creating a community in which students and teachers are learners together (Lambert 1998). Many researchers and teachers in schools have given thought to the benefits of teachers working collegially with other teachers, but findings in this study may lead to closer examination of the inclusion of students in this collegial group, especially in the area of technology integration where students possess a technological skill set beneficial to the educational goals within the classroom. These findings may also lead to further studies of benefits to student learning when students work to support their teachers.

Implications for Research

The research findings suggest that more professional development solutions need to be designed and supported that meet the needs of teachers as they integrate technology into their classes. Research indicates that the integration of technology can be transformational in nature and can lead to a change in teaching practice. Perhaps studies need to happen that examine the entire area of professional

development and the historical connotations surrounding the term itself. Research may examine moving teachers to a space where they themselves are encouraged to create new knowledge about teaching in a constructivist environment. This practice may be an effective model to replace or supplement traditional professional development practices. The inclusion of students as co-learners and instructors in the professional development, or professional understandings, of teachers may be an effective catalyst to the integration of technology. There needs to be more research in this area. Other areas of research may include further studies exploring the integration of technology and its relationship to (a) constructivist teaching practice and the adoption of technology, (b) constructivist practice and student-teacher collaboration, and (c) constructivist practice and teacher change.

Constructivist Practice and the Adoption of Technology

Research by Becker (1999) has shown that teachers' preferred teaching styles usually shape the way they use technology. That is, "traditional teachers" are far less likely to use technology in their teaching than are "constructivist" teachers who (a) design activities around student and teacher interests, (b) work collaboratively, (c) focus on understandings rather than facts, and (d) engage in learning in front of students. Becker's research points to the need to do much more than teach technology skills to teachers and, if a constructivist teacher is one who willingly embraces collaborative learning and learning in front of students, then perhaps further research will provide understandings of the benefit of not only learning in front of students but, in the case of technology, of learning from students.

Constructivist Practice and Student-Teacher Collaboration

Student tasks in a constructivist environment often resemble tasks in the real world, that is, they are authentic activities (Jones et al., 1994). There is a strong emphasis on facilitating student interest rather than following a course outline. As well, a constructivist teaching style encourages the participants to work in collaborative teams to (a) facilitate exposure to others' thinking and (b) to develop a social expectation supportive of learning (Brown, Collins, & Duguid, 1989). Students teaching teachers about technology supports a constructivist environment in that students and teachers are involved in an authentic task as a collaborative team; they are exposed to each others' thinking and they are supporting each others' learning. In this case, the teacher assumes the primary role of the learner and is actively following his or her interest. More research is needed to examine the effectiveness of this model of constructivist learning in technology implementation where teachers become the primary learners and are creating shared understandings with their students.

Constructivist Practice and Teacher Change

In high technology-use schools such as the Apple Classrooms of Tomorrow Schools, it was found that, as teachers became more familiar with technology, they began to use computers as tools for productivity and problem solving rather that as vehicles for drill and practice (Sandholtz, Ringstaff, & Dwyer, 1997). These researchers also argue that the process by which teachers learn the principles of using computers results in changed beliefs about how to improve student understandings and competencies. However, more studies are needed about how effective computers are in motivating teachers to adopt a constructivist approach to their teaching

practices, and if the process of learning technology from their students may be a catalyst in facilitating that change.

Implications for Policy Makers

The Curriculum Standards Branch of Alberta Learning approved the *Information and Communication Technology, Kindergarten to Grade 12 Program of Studies* (Alberta Learning, 2002) in June 1998. Mandated implementation commenced September 2000 and full implementation was to be completed by September of 2003. The requirement of implementing technology in schools has caused a great deal of anxiety among educators in Alberta (Jacobsen, 2001). Part of the anxiety stems from the shifting role of the teacher who makes effective use of technology in the classroom. Researchers such as Jonassen, Peck and Wilson (1999) and Norton and Wilburg (1998) argue that children and adults approach technology very differently and that teachers who were trained to deliver instruction based on the idea of transferring knowledge from expert to novice are under great pressure to integrate an ICT curriculum that is designed to change the way they teach.

Research suggests the importance of school boards and other policy makers understanding that integrating technology means more than installing hardware and software that simply enables teachers to continue teaching the way they always have taught. This study may assist policy makers in understanding that, as teachers are learning to change teaching practices, they need time and resources to support this change. The administrative support of effective professional development should take into account an understanding of how students approach technology and of the role

students may have in the learning of their teachers. Becker (1999) suggests that use of computers is more consistently related to certain types of changes in practice than is other factors and that Internet use seems to be related to teachers being more willing "to discuss a subject about which they lack expertise and allowing themselves to be taught by students" (p. 14). However, Becker states that there needs to be more research done in this area.

Implications for Pre-Service Education

Teachers seem to be comfortable teaching in the manner in which they were taught. When I completed my Master's Degree from the University of Alberta in 1994, I was in a summer institute class. The topic of the class was about collegiality, and the readings centred on some of the work of Susan Rozenholtz (1989). Our professor, in talking about the benefits of collegiality and student-centred environments, framed her entire course in a constructivist manner. We were given authentic problems to solve in collaboration with our peers. As we headed to the cafeteria or to the student lounge to discuss the previous day's readings, other instructors would be giving our professor a "bad time" for her "slack" teaching methods. That was the first time, however, that I had experienced learning in a formal class with an assessment component where I was in charge of my own learning. I think a greater number of teachers would adopt constructivist teaching methods were they able to experience this teaching method as learners in their pre-service training.

Reflecting on Moersh's Model

As I reflect on Moersch's (1995) model and on my study of teachers' adoption of technology, I agree with Moersch that teachers do indeed go through stages of integrating technology into their classrooms. In his model, Moersch describes mechanical integration as a level where teachers perceive technology as a tool to solve authentic problems, but where there is heavy reliance on pre-packaged material. From there, according to Moersch, teachers move to routine integration where they are able to readily integrate technology with little outside intervention. In the final or refinement stage, students, according to Moersch, have ready access to a wide array of technology-based tools, and technology is perceived as a vehicle used to solve authentic problems.

I suggest that perhaps Moersch's stages of technology implementation do not exactly reflect teachers' practice. In many cases, I believe that teachers reach parts of the refinement stage, that stage where teachers enable students to access and use a wide variety of technologies before they feel that they themselves have mastered the routine integration stage, the stage where teachers are able to use technology with little outside intervention. My understanding of Moersch's integration stage is that when he describes teachers as readily integrating technology-rich tools at this stage, he is implying that teachers are in control of what technologies are being used and how they are integrated. Today's teachers, however, are faced with a wide variety of technologies that require ever-changing skills to master. Teachers in the study reported that they were insecure and unsure when planning to integrate some

technologies if they were singularly in charge of organizing the learning for students. However, when students were in charge of their own learning, and when teachers saw themselves as enablers, or co-learners, these teachers were much more confident that they would not be put on the spot and that students would benefit from the use of technology.

Perhaps there needs to be research conducted to examine the possibility that there may be an "enabling stage" in the scale of technology implementation. In this stage teachers and students enable each other in the use of technology as a tool to construct knowledge and to solve problems. This stage may occur before or instead of the routine integration stage as teachers begin to see the value of using technologies in constructivist classrooms. Or, the research may show that the process of technology integration by teachers may not be linear as stated by Moersch, but may involve a back and forth or circular process where students are key players in supporting teacher learning in technology.

Chapter Summary

The discussion in this chapter centres on student understandings of the professional development activity as well as discussions about effective professional development, teacher adoption of technology, Moersch's model of technology integration, and implications for practice. The discussion about professional development specifically centres on effective professional development in technology as it connects to the curriculum, provides support, and leads to change in teaching practice. The discussion also visits the use of technology in a constructivist classroom

and the implications for practice, research, policy makers, and pre-service education. The final discussion focuses on the need to examine the stages that teachers go through as they implement technology into their classes and to understand the role students may have in that implementation.

CHAPTER SIX

QUESTIONS AND REFLECTIONS

The idea for my study began when I was involved in coaching. I had coached basketball, volleyball, and track and field for several years as a Physical Education teacher and even, to meet a school need, coached cheerleaders. I knew nothing about cheerleading, but together the students and myself attended cheerleading camps and learned together. What fun we had! I then had confidence to volunteer to coach my son's PeeWee hockey team. I had never been a hockey player, but all through the very successful season the thirteen year old boys and myself learned from each other.

When I enrolled in the doctoral program, I was the AISI coordinator in a high school and was asked to help run a provincial basketball tournament. I was impressed with the enthusiasm and willingness shown by the teachers as they spent hours working with students (and using technology) to ensure the success of the tournament. At the same time I was wondering how to best get teachers excited about and committed to technology integration in their classes. At the end of my study, I find it appropriate to frame my final thoughts around the idea of coaching and of (a) being a coach, (b) implementing best coaching practices, (c) seeking best facilities for the teams, and (d) working with teams and organizations to achieve common goals. The following discussion is framed around coaching, but the coaching is within the context of teachers and students as they coach each other in the integration of technology in their schools.

Being a Coach

Evered and Selma (1989) have described coaching metaphorically as a means "to convey a valued person from where he or she is to where he or she wants to go" (p 16). One may assume that, to be effective, a coach must be a proficient leader and an expert in the task at hand. However, in many endeavours, including technology integration in schools, the conveyence of a valued person to where he or she wants to go may be accomplished simply by clearing the road, or *enabling*.

When the new Information and Communication Technology (ICT) curriculum was implemented in Alberta, teachers were asked to integrate technology into their lessons and to use technology as a tool. However, many teachers assumed that the ICT curriculum required schools to eliminate classes that, in isolation, focused on computer applications and keyboarding and that all teachers were to teach those applications and computing skills as an "add on." Teachers were concerned that they had neither the time nor the expertise to effectively complete this task.

In my experience, many teachers, as they work with technology, do not fully understand that most new curricula now reflect a constructivist framework in which the teacher assumes the role of a coach or indeed, an enabler. Teachers in this model are asked to do what any team coach would do--to use available resources to maximize the success of their students or "team." Teachers who work within a constructivist framework realize that students are more likely to be successful if they are asked to address authentic problems and actively set out to acquire, evaluate and share information (Jonassen, Peck & Wilson, 1999). These teachers also realize that

to achieve these goals effectively, it is essential that the students and teachers use technology.

If teachers are to be coaches or facilitators in a technology-rich learning environment, what does this really mean? Most athletic or cultural coaches work with players on their team who possess a stronger skill set than the coaches themselves can demonstrate. The coach's responsibility is to find methods of enhancing the performance of individual players and of the team as a whole--to motivate, to inform, and to provide opportunity for the team and each team member to master and to even extend current best practices. Teams and coaches possess a shared goal--that of success. Teachers, or *coaches of learning,* then, rather than concentrating on the integration of technology per se, may be more successful if they too focus on ways to motivate, inform and provide opportunities--opportunities that enable their students to become inquirers, critical thinkers, and problem solvers.

One method of using technology within the framework of an authentic task, for example, is to use PowerPoint in presentations in order to persuade or to inform an audience about a real-world problem. I was recently discussing technology integration with an English Language Arts teacher who stated that she did not understand why she should have to use language arts class time to teach her students how to use PowerPoint. I explained that her job was to encourage students to deliver effective presentations. I told her that students, if given access to appropriate technology, would experiment and learn how to use PowerPoint in order to best achieve the task at hand. I assured her that her job was to enable her students and, from that point, she and her students could learn from each other. "Why didn't

someone explain that to me before?" she answered. "It seems so simple when you put it that way."

Upon reflecting on my study, I think that the role of effective coaches in technology, whether the coach is the student or the teacher, is to effectively mentor, support, and enable others. The result of this mutual enabling is that teachers and students learn how to use technologies that best enrich and enhance teaching and learning, thus achieving the common goal of team success.

Best Coaching Practices

Personal Reflection

I realize from my study that educational leaders and researchers encourage the use of constructivist approaches to teaching practice as described by Brooks and Brooks (1993). Research also suggests that computer use can act as a catalyst in helping teachers to accomplish constructivist approaches that might be more difficult to attain without readily available technology (Jonassen, Carr & Hsui-Ping, 1998).

How does this realization and reflection influence my own teaching practice? I am currently teaching an on-line course for the Faculty of Education, University of Alberta. I understand now that I would be a more effective teacher, or coach, if I were to adopt a strong constructivist, teaching framework. I would like my students to experience being taught in the manner in which they are expected to teach. How can I best accomplish these goals?

The goal of the course I teach, a graduate level course in using information technologies, is to examine best methods of using technologies for learning in schools. As a result of this study, I have examined my course planning in terms of the beliefs and practices of constructivist pedagogy as outlined by Brooks and Brooks (1993). I paid particular attention to (a) the tasks given to students, (b) the structure of the curriculum, and (c) the general teaching style.

The Task

Student tasks in a constructivist approach often resemble tasks in the real world--in other words they are authentic tasks involving synthesis and problem solving. In the course, I ask the students to lead and participate in discussions about their readings, to find an appropriate research article, to write a research paper, and to design a webquest for use in their classes. Although the webquest is an authentic task for individual classroom use, the assignments as a whole ask the students to research and reflect about information technologies, but do not encourage them to be problem solvers involved in real-world solutions.

How could I design an authentic task for my students? In this course student reflections often centre around the need for teachers and teacher-librarians to have available a quick resource dealing with school-related issues such as censorship, acceptable use policies, evaluation of websites, effective research techniques, samples of constructivist assignments, professional development, and so on. If the task assigned to my students was to collaboratively construct a website designed to assist teachers and teacher-librarians across the country, the focus of the course changes from students summarizing and manipulating existing research to students actively

solving a real world problem. Students in this approach would be required to use a wide range of skills, deal with ambiguous issues, and make significant choices in order to create a meaningful resource for others in the field. Rather than sending me their research papers in isolation, papers could be posted to the web for discussion and could be used as a resource by a much wider audience than simply one class. Others outside the class could tap into student ideas and reflections about information technology issues, even at a later date, and together, through collaboration and discussion, new understandings and solutions might emerge.

Links to the newly created student webquests could be included as could updated comments and changes as these assignments are improved and advanced. And in this case, true to constructivist teaching, planning and decision making become the students' responsibility and an authentic task is designed that is seen by the class as beneficial to the students themselves.

The Structure

The structure of a constructivist class includes "project management skills, research skills, organization and representation skills, presentation skills, and reflection skills" (Jonassen et al., 1998, p. 29). If the students in my course were to design the webpage, research and share best practices, and effectively present their reflections and understandings, those goals would be met. Also, broad coverage of a thematic issue--that of information technologies in schools--could be examined in depth with the goal of students examining intellectual issues while exploring solutions to these issues that are meaningful and engaging. As the structure becomes

more procedural than factual, the use of technology becomes a tool rather than a vehicle through which to transfer information.

The Teaching Style

The style I must adopt goes back to coaching. Coaches work at enhancing the individual and team skills of their players. In the new model for my course, I would assume the role of enhancing student initiative rather than following a tightly scripted course outline. If I understand that student knowledge must be constructed rather than learned, I must give my students latitude and space to design the webpage and to reflect on their understandings. I also must be sure that students collaborate so that they are exposed to each other's thinking and understandings and develop a social network that supports constructivist learning.

As I reflect on the findings and experiences of my study, I realize that perhaps the most important change in my teaching practice is that to be an effective constructivist teacher, I must model effective learning. In this case, just as the teachers in my study, I believe I will be supported and will be able to acquire new skills and understandings through interacting with and learning from the students themselves. If students are able to use a type of technology that I am not familiar with, but is effective on the website, I am sure that they would support me if I wished to learn how to master that skill. More importantly, if I situate myself as a learner, I can demonstrate how new understandings can emerge through dialogue and negotiation.

Team Facilities

Coaches in modern schools for the most part work with solid and effective facilities and infrastructure. They are used to basketball and volleyball courts with standard equipment, painted floors, lights, and so on. Coaches may have input as to what type of small equipment, balls and so on would work best for them, and they do the best to maintain and repair the small items as best they can. A coach's focus, however, becomes working with the team on skills and organizational systems to ensure team success.

In the case of technology implementation, standards such as gymnasiums were not in place, and policy makers for the most part created computer labs and infrastructure without consulting the teachers who were going to work with the new technologies. Cuban (2003) stated that "making changes in what teachers do in their classrooms requires paying attention to the daily workplace conditions and constant external demands, the lack of respect they receive for their expertise, and the inherent unreliability of the innovations themselves" (p. 10). Gibson and Oberg (in press) state that "decades of research investigating the implementation of new technologies in schools suggests that technology use needs to be supported with a foundation of infrastructure development and teacher learning if new technologies are to improve student learning" (p. 1).

When technology was to be implemented in my district, representatives from each school were invited to be on the technology committee. Most chosen were those who were already teaching in the area of CTS (Career and Technology Studies), that

primarily dealt with mastering computer skills and applications. These teachers, in retrospect, likely were the least constructivist-oriented teachers of all, as CTS courses were designed in a structured, linear fashion, were sequential, and involved an abundance of drill and practice. These teachers' influence may have led to the understanding that more computer use in schools meant more labs just like the old typing rooms, and that these labs were meant to facilitate even more teaching of keyboarding, applications and so on. Many teachers saw the role of computers as a technology that let them continue doing, in a fancier way, what they were doing already.

What differences might have occurred if teacher-librarians and teachers who embraced problem-solving and engaged learning activities had been on those initial committees? What differences might have occurred if students had been included in initial discussions?

This year, with the installation of Supernet (high speed Internet) throughout Alberta, some rural school boards are examining distributive learning as a method of solving problems dealing with lack of staff and small high school enrolments. Again, in some instances, non-educators are designing classrooms and videoconferencing centres without involving the teachers whom they expect to be teaching with these new teaching practices. The mindset is that the videoconferencing will be used primarily to deliver course "content" and that a "talking head" will be able to effectively deliver course content simultaneously to multiple classes. In this case, we still will be using expensive technologies to do what we have always done. To be

effective, policy makers need models, examples, and education about the relationship between the use of technology and changing practice.

Organization

As in any team endeavour, a network of people must work together to successfully achieve a common goal. Infrastructure, professional development, policy makers, curriculum specialists and school boards all play key roles in the implementation of technology. In my experience, however, the *method* by which something is learned has a great effect on how that knowledge is understood and ultimately used. I have realized in my study that good professional development involves relationships. Both students and teachers in this study valued the relationships inherent in the professional development activity. We understand that using technology may be a catalyst to change teacher practice, but because of the positive relationships involved, learning technology *from students* may also be a powerful catalyst to teacher change. If teachers need to be supported in change, need to be involved in change as a learner, and need to understand how technology will benefit student success, what better way to learn than from their students? In this case, the students become effective coaches who are genuinely interested in helping their teachers to master authentic and meaningful tasks. Perhaps as teachers begin to see themselves as student *enablers,* they will also realize that as they learn to use technology it is the *students* who become *enablers* in the learning of their teachers.

Chapter Summary

I have framed the final discussion around the idea of a constructivist teacher assuming the role of a coach or a facilitator. Learning to effectively use technology is a challenging task for teachers, and teachers may want to examine including students as partners as they become constructivist teachers or coaches. As teachers assume the role of facilitators, they may find themselves thinking about technology use and how to become a classroom coach, to implement best coaching practices in using technology, to seek and design the best computer-use facilities and to work with teams and organizations, including their students, to achieve the common goal of effectively using technology in their schools.

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Appendix A

Initial Letter to Teachers

May 19, 2002

Dear_____,

My name is Lorine Sweeney and I am a doctoral student in the Department of Elementary Educational at the University of Alberta. I am writing you to invite you to participate in my research.

The purpose of my research is to seek insight into the experiences of teachers and students who have participated together in a technology-related professional development activity. Prior research in this area has addressed the importance of professional development in technology and of school growth and improvement. However, the idea of students and teachers learning together still needs to be examined more deeply. I wonder about teachers' sense of learning together with their students and how this process affects them as professionals.

In my study I will be observing and engaging in conversations with four teachers and four students who have attended a professional development together. I am inviting you to be one of the participants. My plan is to conduct semi-structured interviews with each participant in order to collect data about his or her perceptions, experiences, and beliefs related to learning along with students in technology. Each interview will last about an hour, and will be audiotaped so that a verbatim transcript can be made. You may also be asked to participate in a second short interview if additional data or clarification is necessary.

I will return the transcripts to you so you can check the accuracy of them, and later ask you to react to the analysis of the interview records. I will then summarize the collected and analyzed data, and share my findings with you. The data will provide a framework for the presentation of my findings. My findings, if appropriate, may be articulated in ensuing articles and/or presentations.

Participation in the study is voluntary, and you may withdraw from the study at any time without prejudice or penalty. All data collected during the study will be secured and confidential, then destroyed upon completion of the study. Your anonymity is assured and your name as well as name of your school or school board will not be revealed. The research will be conducted as approved by the University of Alberta's Research Ethics Board, and in a manner respectful of your teaching practices.

As an educator who possesses a keen interest in professional development related to technology, I think my research in this area will benefit from your insights. There are no known risks associated with the study, and I feel that you will find the experience affirming to your professional practice. Please feel free to call me with any questions or concerns you might have at 853-2772 or w-mail me at loriswee@jrrobson.btrd.ab.ca . I will contact you about a week after you would have received this letter to see if you are interested in being a participant. Thank you for considering this invitation.

Sincerely,

Lorine Sweeney

Appendix B

Initial Letter to Students

May 19, 2002

Hello!

My name is Lorine Sweeney and I am a doctoral student in the Department of Elementary Educational at the University of Alberta. I am writing you to invite you to participate in my research.

The purpose of my research is to seek insight into the experiences of teachers and students who have participated together in a technology-related professional development activity. Prior research in this area has addressed the importance of professional development in technology and of school growth and improvement. However, the idea of students and teachers learning together still needs to be examined more deeply. I wonder about teachers' sense of learning together with their students and I wonder about your experience in teaching and learning with one of your teachers.

In my study I will be observing and engaging in conversations with four teachers and four students who have attended a professional development together. I am inviting you to be one of the participants. My plan is to conduct semi-structured interviews with each participant in order to collect data about his or her perceptions and experiences,. Each interview will last about an hour, and will be audiotaped so that a verbatim transcript can be made. You may also be asked to participate in a second short interview if additional data or clarification is necessary.

I will return the transcripts to you so you can check the accuracy of them, and later ask you to react to the analysis of the interview records. I will then summarize the collected and analyzed data, and share my findings with you. The data will

provide a framework for the presentation of my findings. My findings, if appropriate, may be articulated in ensuing articles and/or presentations.

Participation in the study is voluntary, and you may withdraw from the study at any time without prejudice or penalty. All data collected during the study will be secured and confidential, then destroyed upon completion of the study. Your anonymity is assured and your name as well as name of your school or school board will not be revealed. The research will be conducted as approved by the University of Alberta's Research Ethics Board, and in a manner respectful of your teaching practices.

As an educator who possesses a keen interest in professional development related to technology, I think my research in this area will benefit from your insights. There are no known risks associated with the study, and I feel that you will find the experience rewarding. Please feel free to call me with any questions or concerns you might have at 853-2772 or w-mail me at loriswee@jrrobson.btrd.ab.ca . I will contact you about a week after you would have received this letter to see if you are interested in being a participant. Thank you for considering this invitation.

Sincerely,

Lorine Sweeney

Appendix C

Individual Interview Questions for Teachers

1. Could you share some of your background and experience in teaching?

2. We both have conducted classes where we have tried to integrate technology as part of the lesson. Can you share with me one prior experiences (good or bad) which included technology integration?

3. Can you share a prior professional development activity that you attended related to technology in the classroom?

4. I would like you to briefly describe the professional development activity that you attended with your students.(probe for information about where, how, who was there, etc.)

5. Before you attended the professional development activity, what did you wonder about, or what did you anticipate? What do you think about your previous thoughts now?

6. I would like to talk about he rewards of participating in the professional development activity with your students.

- What do you see as the rewards to yourself as a teacher?
- What do you see as rewards to the students?

7. What do you see as costs, problems, or limitations of being involved in this model of professional development?

8. Do you think participating in this type of professional development has affected your relationship with your students? If so, how? (probe if necessary)

9. Do you think this experience has affected your professional beliefs and practices? If so, how?

10. If you were in charge of technology integration in your school, would you recommend this type of professional development activity to colleagues? If so, how would you describe it to them?

11. Has this experience altered your attitude in any way toward technology integration?

12. Can you account for the way students reacted at or after the professional development activity?

13. Were there any challenges you faced as a result of participating in the professional development activity?

14. Would you participate in this type of professional development activity again? Why?

Appendix D

Individual Interview Questions for Students

1. Could you share some of your background in technology?

2. I would like you to briefly describe the professional development activity that you attended with your teacher.

   (probe for information about where, how, who was there, etc.)

3. Before you attended the professional development activity, what did you wonder about, or what did you anticipate? What do you think about your previous thoughts now?

4. I would like to talk about the rewards of participating in the professional development activity with your teacher. What do you see as the rewards to yourself as a student?

5. What do you think might be the rewards for the teacher?

6. What do you see as problems for students being involved in this model of professional development?

7. Do you think participating in this type of professional development has affected your relationship with your teacher? If so, how? (probe if necessary)

8. Do you think this experience has affected your beliefs about technology in the classroom? If so, how?

9. If you were in charge of technology integration in your school, would you recommend this type of professional development activity to another student? How would you describe it to them?

10. Can you describe the way teachers reacted at or after the professional development activity?

11. Were there any challenges you faced as a result of participating in the professional development activity?

12. What do you feel are the limitations of this type of professional development activity? For whom?

13. Would you participate in this type of professional development activity again? Why?